THE
LARYNGOSCOPE.

VOL. LI SEPTEMBER, 1941. No. 9

OTOGENIC COMPLICATIONS. A RESUME AND DISCUSSION OF THE LITERATURE FOR 1940.

DR. LYMAN G. RICHARDS, Boston.

In surveying the literature of the past year which deals with the complications incident to otitic sepsis, certain outstanding features are to be noted in contrast with the writings of previous years. One is the preponderant number of articles dealing with meningitis, comprising more than 70 per cent of the total, a fact unquestionably due to the increasing use of chemotherapy in this formerly fatal condition and the notable success attendant upon this form of treatment. Second is the paucity of literature in the foreign journals, bearing pathetic testimony to the influence of the war on the normal course and progress of scientific investigation and the resultant diminution of contributions from sources formerly so fertile in the field of medical endeavor. The small number of articles on sinus thrombosis is likewise probably attributable to the reduction in occurrence of this complication through the use of chemotherapeutic methods of treatment. It is also interesting to note that after the abundant years of 1938 and 1939 the subject of petrositis now undergoes a marked decline so far as its treatment in otologic literature is concerned, and labyrinthitis, represented by only two articles, seems to have struck an all-time low. This fact, however, may to some extent be explained by the frequent inclusion of such cases under the heading of meningitis when the portal of entry was primarily through the labyrinth.

As in past years, the articles reviewed will be classified according to involvement of: *1.* the meninges and subarach-

Editor's Note: This ms. received in Laryngoscope Office and accepted for publication, Sept. 1, 1941.

noid spaces, *2.* the labyrinth, *3.* brain tissue, either cerebellar or cerebral, *4.* the lateral sinus and its subdivisions, and *5.* the petrosal pyramid. The use of chemotherapy and articles dealing with it apart from its clinical application to otitic sepsis have been necessarily omitted.

Reporting for the Chicago Committee on Otogenic Meningitis for 1939, Lewy[1] describes briefly several cases of otitic meningitis among which are included the following:

1. The case of a boy, age 1 year, with type IV pneumococcus cultured from the spinal fluid and blood, on whom a bilateral mastoidectomy was performed. Type IV rabbit serum and sulfapyridine were administered, with recovery of the patient.

2. A girl, age 10 years, suffering from chronic mastoiditis and obstruction of the left jugular vein, was operated upon, with removal of a purulent thrombus from the lateral sinus. The jugular vein was ligated, cultures of the spinal fluid showing streptococcus viridans. In spite of subsequent apicectomy, administration of sulfanilamide and sulfapyridine and blood transfusions, the disease ran a fluctuating and prolonged course, with downward tendency and ultimate demise of the patient. Two other cases are cited to recount recovery from mastoiditis and meningitis after operation and administration of sulfanilamide, the organism in one case being the streptococcus hemolyticus and in the other, type III pneumococcus. Lewy concludes that sulfanilamide is useful against type III pneumococcus, but that for infection of the meninges with other pneumococci, sulfapyridine appears to be the remedy of choice, supplemented by appropriate serum, which should, in part, be administered intraspinally. Intravenous use of sodium sulfapyridine may obviate gastric distress.

In reviewing the English literature on pneumococcic meningitis, Gilmore and Sacks[2] include details of a case of a boy, age 8 years, who suffered from pneumococcus type 18 meningitis, complicating middle ear disease and mastoiditis. He was treated with sulfapyridine and with type 18 antipneumococcic rabbit serum intramuscularly, undergoing at the same time an opening of the mastoid cortex. His ultimate recovery is attributed by the authors to surgical intervention which stopped further invasion of the meninges, and to

chemotherapy. Sulfapyridine inactivated the pneumococci and prepared them for phagocytosis. Specific serum, by augmenting the patient's immune bodies, helped to overcome toxicity of the invading organisms and contributed to their destruction. Transfusions replaced elements lost by the blood as the result of the infection and the drug. In addition, hypodermoclysis overcame the dehydration and increased the flow of cerebrospinal fluid. Sulfapyridine level in the blood ranged between 4.2 and 13.3 mg. per 100 cc. In addition, these authors cite the case of a man, age 35 years, who developed meningeal complications secondary to a chronic otitis media. After the performance of an endaural radical mastoidectomy and intensive treatment with sulfanilamide, the infecting organism being the streptococcus hemolyticus, he ran a rapid downhill course with expectation on the part of those caring for him that he would surely die. With the temperature reach-106° and the patient in coma, it was decided to discontinue chemotherapy, following which the man made a slow but definitely progressive improvement. The authors conclude that the chemotherapeusis, forced in this case because of the patient's desperate condition, was at least partly responsible for the continuance of the fever and coma and that its discontinuance brought about a favorable change in the patient's condition. The authors feel that the use of sulfapyridine and of specific serum is limited to a definite phase in the cure of pneumococcic meningitis. Sulfapyridine inhibits the growth of the organism but does not destroy them. Specific serum helps the bodily forces and clearing mechanism involved in destroying the organism and in neutralizing the toxins. Chemotherapy and serotherapy combined will result in recovery when either of these methods alone will not. Surgery on the temporal bone, performed early enough, may be a deciding factor between success and failure. As supportive treatment, blood transfusions and sufficient sodium chloride should be administered whenever indicated. In addition, the authors summarize 111 cases of pneumococcic meningitis followed by recovery, among them 27 of otitic origin.

An extensive article by Wyllie[3] deals with the general subject of meningitis, its various bacteriological subdivisions and with the dosage, methods of administrations and complications incident to chemotherapy. From the standpoint

of the otologist, it is startling to read in the final sentence that "in the otitic condition, myringotomy may be necessary, but further operation is not usually required." This English point of view is strangely at variance with that obtaining in this country, in which thorough eradication of the focus of infection is considered a prime essential in the treatment of otitic meningitis.

Two cases illustrating the principles of management in cases of otitic meningitis are given in considerable detail by Carruthers.[4] He stresses the importance of adequate surgical exenteration of the focus of infection and pays tribute to several distinguished American otologists who have popularized the deeper approaches to the labyrinth and petrous portion of the temporal bone. In the first of his cases, the patient had an embolic infection with the site of focus in the left side of the brain. This was not amenable to drainage and in spite of the administration of sulfanilamide, the patient failed to recover. In the second case, thanks to the ability to apply a technique for obtaining access to deeply seated foci in the temporal bone, the author was able to provide an escape for the infection which had been feeding into the meninges. As a result of the application of sulfanilamide therapy, together with frequent blood transfusions, there was brought about a cure of the infection which had established itself in the meninges, with complete recovery of the patient. The author feels that if the feeding foci can be reached adequately, cure may be expected in a large percentage of cases with sulfanilamide and blood fortification.

An interesting point in the treatment of otitic meningitis due to the type III pneumococcus is brought out by Critchfield, Simons, Emmens and Newell.[5] They report the case of a young woman, age 18 years, whose admission diagnosis was acute suppurative otitis media and purulent meningitis. She was given intensive treatment with chemotherapy, repeated blood transfusions and numerous spinal fluid taps. Otological consultation recommended only incision of the right drum for improved drainage. The question of immediate mastoid surgery was considered but decided against in spite of tenderness over the mastoid itself. In discussing the case, they defend this conservative treatment of the evident right mastoiditis by citing the fact that intravenous sodium sulfapyri-

dine was available and being administered, and claimed that reports in the literature are more and more advising against surgical interference in similar circumstances. They stress the importance of the early diagnosis of the bacterial agent causing the purulent meningitis and the importance at the time of the first spinal drainage, of taking steps to determine the causative organism. This, they feel, calls for active co-operation and skill on the part of the medical and laboratory staff. They believe that recovery in all probability depended upon early and efficient administration of sulfapyridine and its sodium salt, the blood concentration being high during the very first days of administration. The only toxic symptom associated with the administration of sulfapyridine was vomiting. This was controlled by intravenous blood and saline administrations, aided by frequent studies of the blood and urine itself, in observation of the patient's response to the drug.

Ersner, Myers and Hayes[6] report the interesting case of a boy, age 15 years, admitted to the hospital with a history of right suppurative otitis media of five weeks' duration with previous swelling for two weeks over the right zygomatic region. An immediate mastoidectomy revealed extensive necrosis and destruction of the zygoma. The lateral sinus and dura of the middle fossa were exposed, due to erosion of the plate of the middle fossa, dura and lateral sinus. Culture at this time was reported to show a pneumococcus, type III. Five days later, meningeal complications developed, spinal fluid showing an increased cell count and evidence, on later culture, of the pneumococcus, type III. An X-ray of the temporal bone indicated involvement of the right petrous apex. The mastoid revision and apicectomy were therefore performed, no pus being found, but with detection of definite necrosis of the cells of the apical carotid portion of the temporal bone. Under treatment with sulfapyridine orally there was marked improvement with clearing of the spinal fluid and return of the temperature to normal. Reduction of the dosage of the drug, however, resulted in reappearance of meningeal symptoms and of cells and organisms in the spinal fluid. Increasing the dosage of the drug again produced clinical improvement with corresponding return of symptoms with reduction of the sulfapyridine. Since it was evident that drug

therapy alone was not sufficient to eradicate the meningeal infection, after a negative Francis test, 25 units of type III antipneumococcic rabbit serum were given intravenously. In addition, the patient was given 8 cc. of his own blood serum intrathecally to supply complements to the spinal fluid. Following this, the Francis test was positive and sulfapyridine was continued as before. On four occasions later, rabbit serum was readministered and blood serum given eight times in addition to eight whole blood transfusions. Daily spinal punctures were done until the spinal fluid was free of cells and organisms. Finally, in the tenth week of illness, symptoms subsided completely and the patient made an uninterrupted recovery. The authors feel that this case illustrates that despite the apparent efficacy of sulfapyridine against the pneumococcus, at times the drug alone is insufficient to overcome the infection and requires the addition of specific sera in supplementing the treatment. This young patient apparently tolerated large doses of sulfapyridine over a long period without ill effect.

Complete eradication of any fixed focus of infection in the mastoid or apical portion of the temporal bone is always important in the treatment of meningeal complications of otitic origin. Reliance on the treatment of otitic meningitis by chemotherapy alone is illustrated by the case of Quirk,[7] exemplifying the method of dealing with such a case in a small rural hospital with limited facilities. A white female, age 36 years, was admitted to the hospital on Feb. 26 with typical otitis media of one week's duration. On small doses of sulfapyridine she made an apparent recovery, with cessation of the aural discharge. On March 2, left-sided facial paralysis was noted but there was no elevation of temperature. Aural discharge returned on March 5, with severe headache on the subsequent day. On the following day the patient was definitely sick, with typical neurological signs of meningitis and with lumbar puncture revealing a thick, turbid fluid, so dense that cells could not be counted. Sulfapyridine therapy was immediately resumed, the patient receiving 135 gr. in the next 12 hours. Owing to severe vomiting, she was given a supplementary dose of sulfanilamide interstitially. In the first 42 hours, the patient received 240 gr. of sulfapyridine and subsequently 112 gr. per day until March 22, the six-

teenth day, when the dose was reduced to 67 gr. per day. This therapy was supplemented by daily spinal drainage for the succeeding week. The spinal fluid cell count at this time was 4,000 cells and smear showed occasional cocci, which on culture proved to be pneumococcus, type III. During the chemotherapeutic course, hemoglobin dropped from 80 to 50 per cent but at no time did the patient show a leucopenia. On April 2 there was still present a purulent discharge from the left ear, which continued for three weeks, with subsequent cessation. Chemotherapy was continued at the rate of 10 gr. t.i.d. until April 27. At this time the patient was discharged, showing no ill effects except a slight, improving, facial paralysis. This case illustrates the interesting point of view of decision not to open the mastoid process and eradicate an apparent focus in the mastoid cells. Such a procedure carried out routinely would, in this reviewer's opinion, lead to rather unfortunate consequence.

An article by Hans Brunner[8] deserves special recognition. He begins by pointing out that more recoveries from otitic meningitis have been reported in one recent year than in any previous 10-year period. This is of particular interest when one recalls that 40 years ago there was discussion even as to the advisability of any surgery in meningitis. He raises the question as to whether these results are due entirely to the administration of sulfanilamide and as to whether the problem of otitic meningitis can now be looked upon as solved.

A review of recent literature reveals that most of the published cases deal with recovery and that very few reports deal with patients who have died in spite of chemotherapy. The reputed fall in the mortality rate from 100 per cent to between 20 and 25 per cent must be considered in the light of the variation in the course of the disease with the pathway of infection from the ear to the meninges. To attempt to throw some light on this problem, Brunner collected 70 cases of meningitis treated with sulfanilamide, taken chiefly from the American literature. In each case the cerebrospinal fluid showed marked increase in polymorphonuclear leucocytes, and smear and cultures were positive from the spinal fluid. In 57 instances hemolytic streptococci were recovered, and in

10 type III pneumococcus predominated. While a cloudy fluid is commonly thought to indicate the presence of generalized meningitis, Brunner points out that not infrequently organisms will be found in the absence of cloudy fluid and a meningitic death has been known to occur in which no organisms were ever found. Only those cases were considered in which the meningitis originated from a suppurative focus within the temporal bone. Meningitis secondary to intracranial complications such as sinus thrombosis or brain abscess were not included since the pathology is of a different nature and not of the primary type. The author separates the 70 cases of otitic and rhinogetic meningitis treated with sulfanilamide into six groups. Of these, the largest, comprising 51 cases, included those instances of infection beginning with otitis media and followed by mastoiditis and meningitis, mostly in young patients between the ages of 1 and 25 years. In a group of eight cases, meningitis followed simple mastoidectomy in young patients from 4 to 14 years of age. Meningeal symptoms appeared three days to two years after operation. In five instances, meningitis followed chronic otitis media, with or without cholesteatoma. The ages of the patients ranged from 8 to 15 years. In addition to the administration of sulfanilamide, a simple mastoidectomy was performed. Two cases of meningitis followed recurrent otitis, and labyrinthitis preceded meningitis in two instances. For the sake of comparison, 64 cases of otitic and rhinogenic meningitis were collected which were not treated with sulfanilamide or its derivatives. All these showed a cloudy cerebrospinal fluid with cells up to 20,000. Hemolytic streptococci were present in 41 instances and pneumococci in 41. Treatment followed a great variety of methods, including incision of the dura, transfusion, antistreptococcic serum, urotropin, staphylococcus vaccine, trypaflavine, intraspinal injections of hypertonic sodium chloride, autogenous serum, colloidal silver, mercurochrome, antimeningococcic serum, acriflavine, intracarotid injections of Pregel's solution and forced drainage of the spinal canal. These 64 control cases may likewise be separated into distinct groups. The largest number, 37, began with acute otitis media and mastoiditis, the majority of the patients being young and ranging in age from 2 to 25 years. In the next group of six cases, acquired meningitis followed simple mastoidectomy. Meningeal symptoms appeared four

to eight days postoperaitvely, the age incidence being from 8 to 15 years. In seven instances, meningitis followed chronic otitis media, with or without cholesteatoma. Most of the patients were under 35 years of age. Seven instances of meningitis followed labyrinthitis, while six others were of rhinogenic origin. From these control cases, the following conclusions may be drawn: *1.* Cure of otitic meningitis most commonly follows acute otitis media — 66 per cent. *2.* There was a definite relationship between prognosis and the patient's age, the best results occurring in patients from 6 to 10 years of age. *3.* The comparison between patients treated with or without sulfanilamide in these two series would lead one at first to believe that there is no striking difference from the use of the drug. This, however, fails to take into consideration that the cases of patients treated with sulfanilamide were published in a period of two years, while those cases representing recovery without the drug were collected over a period of almost 40 years, giving positive evidence of the increased chances of recovery from general purulent meningitis by treatment with chemotherapy. Sulfanilamide may not be the sole factor in recovery but it has definitely improved the prognosis in this disease. One must not, however, exaggerate its efficiency to the point of considering mastoid surgery as unnecessary. The advice of Jansen given many decades ago that the first symptom of meningitis is the last summons to operate must still be considered valid today. This point requires emphasis since in the series of cases treated with sulfanilamide, there were 13 instances in which recovery from otitic meningitis was reported without operation on the mastoid. Brunner states his present *modus operandi* with respect to cases of otitic meningitis to be as follows: In acute cases, the performance of a simple mastoidectomy; in chronic cases, a radical mastoidectomy with wide exposure of the dura in both instances. In order to prevent adhesions within the meninges, he advocates withdrawal of about 30 cc. of cerebrospinal fluid and compensation with an injection of 20 to 25 cc. of air. Prontosil is administered in dosage of 1 cc. for each pound of body weight during the first 24 hours, and for sulfanilamide, three-fourths of a grain per pound of body weight in the same time. The dose is greatly reduced when the maximum blood concentration has been obtained. Blood transfusions are used to combat and prevent general

debility. Unfortunately, chemotherapy has not yet solved this important problem and the following points must always be given due consideration: *1*. The general physical condition of the patient, usually in turn depending on the patient's age. Prognosis in elderly people is poor, particularly when there is present some cardiovascular disease. *2*. The strain and virulence of the bacteria. Where the latter is low, recovery is far more hopeful than where it is high, as manifested by the fact that bacteria appear repeatedly in culture as well as on smear. *3*. Intensity of the encephalitis. With every meningitis there is some degree of pathological change within the cerebral cortex, either slight and appearing as a mild reaction or marked in the form of a true encephalitis. The more marked the latter, the worse the prognosis. The more deep-seated the encephalitis, the more prominent will be peripheral neurological signs such as that of Babinski. *4*. Time of operating. Operation should be performed as soon as the diagnosis of meningitis can be made by spinal puncture. Furthermore, thorough chemical and bacteriological study of the spinal fluid should be made as advocated by Kopetzky. It must be remembered that in children and young persons an increase in cells of the spinal fluid may be found in acute otitis and mastoiditis without indicating true otitic meningitis. *5*. Pathway of infection. Invasion of the meninges may be by a single pathway or by several pathways simultaneously. The more multiple the pathways and sources from which the infection comes, the more generalized the meningitis and the less likely it is to be circumscribed. Meningitis, as shown by Alexander, which originates in the posterior fossa has a definite tendency to stay circumscribed for a long period, while meningitis originating in the middle fossa very quickly travels into the posterior fossa. Multiple pathways are more commonly found following acute otitis media and in rhinogenic meningitis, where infection travels along the sheath of the olfactory vessel. Simple invasion is more common in cases of chronic infection secondary to middle ear disease and to chronic involvement of the frontal or ethmoidal sinuses. Here, one usually finds infection of the tegmen tympani and if, at this stage, operation is undertaken and the dura widely exposed, recovery as a rule takes place. Delay in operation may lead to a pachymeningitis externa, with recovery still possible with wide exposure of the meninges or still later to

a circumscribed leptomeningitis. Even in this case, operation may be successful in younger people but with the aged, operations may convert a circumscribed leptomeningitis into a more generalized form very rapidly. Operation should, therefore, be undertaken during the stage of circumscribed meningitis since this usually lasts long enough to be recognized.

Summarizing, Brunner stresses the importance of distinguishing between cases of meningitis which have *per se* a good prognosis and those which from the onset have a bad prognosis. To the former belong all kinds of meningitis ushered in by a stage of circumscribed meningeal involvement, provided they are operated on during that circumscribed stage. The otitic meningitis of this type includes particularly cases of cholesteatoma on the middle ear and cases of labyrinthitis. With multiple invasion of the meninges, as often follows cases of acute otitis media, the prognosis is generally poor. The circumscribed stage practically does not exist and much depends on the age of the patient, the virulence of the bacteria and the degree of infection of the brain itself. Young persons have a better prognosis than older ones, and sulfanilamide has helped considerably to improve the outlook.

McKay and Hurteau[9] report on four cases of pneumococcic meningitis treated with sulfapyridine, two of them following otitis media. In the first of these, the patient, a boy, age 8 years, was treated only by chemotherapy and incision of the drum membrane on the involved side. In the second case, that of a man, age 39 years, a simple mastoidectomy was performed 54 hours after the myringotomy. Recovery in both cases leads the author to draw the following conclusions: *1.* The possible ill effect of the drug on the general system may be minimized in view of its effectiveness in controlling the meningeal infection The only major toxic effect observed in these four cases was one example of renal complication. *2.* More rapid and complete response may be expected if specific serum is used in addition to the sulfapyridine. Low blood levels in cases of using serum were not accompanied by exacerbations of the disease, as was the case in those not receiving serum. *3.* Efficiency of the use of sulfapyridine depends on the maintenance of high blood and cerebrospinal levels. These are subject to rapid fluctuations owing to the variability in absorption of the drug. Dosage

by mouth cannot be depended upon as an index and frequent blood and cerebrospinal fluid concentration determinations are essential to indicate future dosage. 4. Administration of the drug cannot safely be stopped in less than two weeks after temperature and cerebrospinal fluid cell count have reached normal.

In considering the many optimistic reports and cures of meningitis by chemotherapy, it is well to give some consideration to the report of Grossman,[10] who reports an analysis of 27 cases of pneumococcic meningitis, of which nine were complications of otitis media. All of the patients were under 1 year of age and the mortality was 98 per cent. It is obvious, therefore, that even in our present stage of therapy, patients within this early age group are still extremely serious risks and must be given a very guarded prognosis.

Frist and Rippy[11] report the interesting case of a woman, age 48 years, suffering from acute otitis media, who shortly thereafter developed clinical signs extremely suggestive of a brain abscess in the temporal lobe. The mastoid cells were negative by X-ray. Suddenly the patient became nauseated, vomited, developed a severe headache and lapsed into coma. Examination at once revealed typical signs of meningitis with a purulenet spinal fluid, which subsequently, by two separate laboratories, was reported to contain a type III pneumococcus. Patient was treated intensively with sulfapyridine and made a rapid and uncomplicated recovery. The authors feel that in all probability this patient had a brain abscess which ruptured into the cerebrospinal system and became converted into a purulent meningitis.

Turnoff, Marenus and Schnabel[12] submit what is claimed to be a summary of all reported cases of pneumococcic meningitis treated with sulfapyridine. Of the 38 case reports, 10 mention otitis media or mastoiditis as the inciting focus of infection. The mortality among these latter was 50 per cent. Nothing is said as to the part played by surgery in connection with the otitic infection.

What is claimed to be the first report on the use of sulfapyridine in streptococcus viridans meningitis is made by Mitchell, Bauer and Hamilton.[13] Of the three case reports submitted, one is that of a boy, age 22 months, in which the

focus of infection was a bilateral otitis media. Smears and cultures of the spinal fluid revealed a streptococcus viridans, and treatment by sulfapyridine resulted in recovery of the patient. This organism is notoriously uncommon as a factor in the great majority of otitic infections.

A summary of 108 cases of meningitis due to the influenza bacillus is reported by Lindsay, Rice and Sellinger.[14] In 73 instances in which a definite predisposing cause could be determined, otitis media ranked third with 18 cases. The authors feel that the former treatment by specific serum and by human complement intrathecally, intravenous serum and adequate supportive treatment by transfusions, fluid and vitamins, should be supplemented by chemotherapy, either sulfanilamide or sulfapyridine. By such an addition, they believe the mortality can be considerably reduced from the former range between 80 and 90 per cent fatality. Their own mortality in a series of 13 cases was 54 per cent.

An excellent summary of chemotherapeutic procedures in the treatment of pneumococcus meningitis is submitted by Steele, Gottlieb and Braun.[15] This is prefaced by an account of a fatal case of type 19 meningococcic meningitis secondary to a midde ear infection, which was followed by septicemia and this in turn by meningitis. Autopsy showed distinct evidence of acute circulatory collapse, which the authors believe to be the result of a toxic product provoked by the pneumococcic infection. Since death occurred in less than 48 hours, there was apparently no consideration of, or opportunity for, aural surgery.

In connection with the increasing popularity of treatment of all forms of meningitis, including those of otitic origin by chemotherapy, it is becoming evident, particularly in the larger cities, that certain physicians particularly fitted by some special training in bacteriology are becoming interested in chemotherapy as a specialty and are thus able to afford their colleagues great assistance in the treatment of these formerly fatal complications. Such chemotherapeutic specialists are apt to be either general internists or general surgeons, less often otolaryngologists. That help from such men is invaluable, particularly to the otologist, in the treatment of his more serious complications, is becoming daily more

evident and the increasing complexity of technical problems associated with chemotherapy is beginning more and more to be evident to the clinician. Since, however, there will still be many otolaryngologists unable to work in conjunction with such chemotherapeutic specialists, it is deemed by this reviewer worth while to submit the following summary by Steele[15] and his colleagues, recognizing that in no one case can a fixed and routine line of attack be carried out. Nevertheless, the following outline will be found helpful and some attempt at approximating it will cover the therapeutic ground in a most satisfactory fashion.

General procedure:

1. Initial lumbar puncture.

a. Do Gram stain of spinal fluid.

b. Do cell count.

c. Culture spinal fluid.

d. Type the pneumococci present.

2. Repeat lumbar puncture every 12 hours until cultures are sterile. Thereafter repeat as necessary to control spinal fluid pressure.

a. Repeat cell count cultures and direct examination for pneumococci and for any evidence of capsule swelling.

b. Determine spinal fluid concentration of drug used.

3. Admission blood culture and daily repeat until blood stream is sterile.

4. Daily blood concentration of drug.

5. Sulfanilamide dosage for adults.

a. Initial dose of 40 gr. of sulfanilamide as soon as diagnosis of meningitis has been made.

b. Repeat doses of 10 to 20 gr. every four hours until blood level of 10 mg. per cent or more and an optimal spinal fluid level has been reached.

c. Thereafter 24-hour maintenance dose of approximately 60 gr. administered in divided doses at four-hourly intervals.

d. Drugs should be continued for several days after cultures of spinal fluid are negative.

e. In event of relapse, resume drug at once.

6. Sulfapyridine dosage for adults:

a. An initial oral dose of 4 gm. (60 gr).

b. Repeat dose of 1-2 gm. every four hours until a blood level of 10 mg. per cent and a spinal fluid level of 5 mg. per cent or more is obtained.

c. Thereafter a maintenance dose of 1-2 gm. every four hours as necessary to maintain blood and spinal fluid levels.

d. Drug to be continued for several days after spinal fluid has become negative.

e. In the event of relapse, resume drug at once.

7. Intravenous sodium sulfapyridine dosage schedule:

a. Intravenous sodium sulfapyridine is given in a 5 per cent solution of the drug in distilled water.

b. An initial dose of 0.1 gm. per kilogram of body weight is injected.

c. Thereafter, 300 gm. per kilogram of body weight is injected every six hours until signs of clinical improvement occur and two successive lumbar punctures are sterile.

d. Then sodium sulfapyridine in doses of 3 gm. per kilogram of body weight is given twice daily for several days longer and then discontinued.

e. Resume intravenous therapy at first indication of a relapse.

8. Intramuscular sodium sulfapyridine dosage:

a. The drug is prepared in 3 cc. vials which contain 1 gm. of the sodium sulfapyridine in solution; 1 gm. of the drug intramuscularly is said to be equivalent to 2 gm. by mouth.

b. One ampule, 3 cc., of the drug is administered deep in the muscle every hour until optimum blood and spinal fluid is obtained.

c. Thereafter the blood and spinal fluid levels can be maintained by injections at four-hour intervals.

d. Dosage will depend on age and body weight.

9. Indications for the addition of antipneumococcus serum to chemotherapy:

a. The presence of bacteremia.

b. Failure of spinal fluid cultures to become sterile 24 hours after the start of chemotherapy.

c. Failure of patient to improve clinically with chemotherapy alone.

d. If patient is under 2 years of age (no antibody formed by patient until after second year of life).

e. If patient is over 40 years of age.

10. Method of administering antipneumococcus typed specific rabbit serum:

a. Large doses should be administered intravenously.

b. Sufficient quantity should be given until there is an excess of antibodies present in the circulation. Material is now available for making such a test for types 1 to 8, inclusive, and type 14. Intracutaneous injection of a 1-1,000 dilution of the typed specific polysaccharid in saline is made. A wheal develops at site of injection within 20 minutes if there is adequate circulating antibodies.

c. As soon as sufficient antibody has been administered intravenously to insure an excess of circulation, enough blood is withdrawn to allow formation of 8-10 cc. of serum (complement), which is injected intrathecally at completion of the next lumbar tap.

11. Heparin may be administered in the following manner, should the physician feel that thromboses are occurring:

a. Add 30,000 units of heparin to 1,500 cc. of normal saline.

b. Administer 40 drops per minute of this solution intravenously for two hours (use Murphy drip bulb).

c. Check clotting time of blood by the five-tube method at the end of two hours, and thereafter as necessary.

d. Clotting time should be maintained at 60 to 80 minutes; approximately 30 drops of heparin-saline solution to a minute will usually maintain clotting time at the desired level.

e. Continuous intravenous heparin-therapy should be continued for a period of 10-12 days.

f. Heparin may be obtained from Connaught Laboratories, of Toronto, and is dispensed in ampules which contain 10,000 units of heparin in solution.

This summary, making due allowance for variation in individual cases, will present to the practicing otologist a composite picture of chemotherapy and will serve as a working guide in almost all cases of otitic meningitis.

The unusual combination of two separate attacks of otitic meningitis in the same patient, one of streptococcal, the other of pneumococcal origin, is reported by Reid and Lipscomb.[16] The patient, a young girl, age 17 years, was first treated in August for acute otitis media, which in six days required a simple mastoidectomy. In two weeks typical signs of septic meningitis developed with characteristic spinal fluid changes, including a growth of hemolytic streptococci. Under intensive treatment with sulfapyridine, the patient made a prompt but temporary improvement following a radical mastoid operation and incision of the dura of the posterior fossa. A sudden recrudescence of the infection occurred on Oct. 20 with return of meningeal symptoms, which again yielded to intensive administration of sulfanilamide until on Dec. 17 the patient was discharged as cured. On May 13 of the subsequent year patient was seized with violent symptoms of meningitis, examination showing purulent spinal fluid, from which was obtained a growth of type E-19 pneumococcus. An abscess was found to occupy the depths of the radical cavity and an incision to yield a half-ounce of pus. Patient was placed on intensive therapy by sulfapyridine and by the middle of June had completely recovered. The authors feel that in the first instance the infection spread as a result of adjacent bone diseases, whereas in the second the route was either by the blood stream from the abscess in the old radical

cavity or through a weakened barrier resulting from extensive bone removal at the previous operation. They quote Leyton, who said that the time may come when it will be common practice to treat meningitis first with chemotherapy and later to deal with the mastoid disease by operation during the convalescent period. This attitude among English surgeons will unquestionably meet with disagreement from most American otologists, who feel that early eradication of a local focus should still be placed first among therapeutic procedures.

In a discussion of the prognosis and treatment of streptococcus meningitis, Menehan[17] cites the cases of four children, all of whom developed streptococcic meningitis as a complication of otitis media. Although in each instance there was a distinct involvement of the mastoid, surgery was not considered necessary and treatment consisted entirely in the application of chemotherapy. All of these patients recovered. In spite of having followed this conservative surgical line of procedure, the author, nevertheless, states it to be his opinion that tenderness over the mastoid, with or without X-ray evidence of bone destruction, should be considered a sufficient reason for surgical intervention. In every case the chance of recovery will be increased by early removal of the focus from which the invasion has originated. Contrary to numerous other authors, he feels that drainage of the spinal fluid by repeated lumbar puncture is a relatively unimportant therapeutic procedure and that such punctures should be done chiefly for diagnosis and for the purpose of following the course of the disease. He stresses the importance of arriving at an early diagnosis in the presence of any intracranial complication following a purulent otitis media, and stresses the necessity of immediate spinal puncture. Sulfanilamide should be started immediately without awaiting results of the culture of the fluid.

Neter and Chait[18] call attention to the rarity with which the Bacillus proteus produces either bacteremia or purulent meningitis. They report the case of a girl, age 14 years, in whom an acute purulent otitis media was followed by mastoiditis, meningitis and bacteremia in which the Bacillus proteus vulgaris was repeatedly found both in the blood and in the spinal fluid. The patient underwent a right mastoidec-

tomy, the cortex containing thick, creamy pus immediately upon opening, with evidence of thick, spongy granulation tissue and cholesteatomatous material in the attic. There were several necrotic areas in the plate covering the lateral sinus and a perisinus abscess was uncovered surrounding the thick wall of the sinus. Dura was widely exposed over the lower and lateral wall of the middle cranial fossa. The dura itself, which was thickened and greenish in color, was incised. Intensive chemotherapy by use of neoprontosil was carried out, but in spite of this the patient died on the eighth day. Autopsy revealed an acute diffuse purulent leptomeningitis, subdural empyema of the right half of the posterior cranial fossa and multiple hemorrhagic areas in the lungs and spleen. Although cultures of the material from the ear and mastoid revealed streptococci, these were overgrown by the Gram negative bacillus identified as B. proteus vulgaris. Although the attempt to cure the generalized infection by means of chemotherapeutic substances of the sulfanilamide group was unsuccessful, the second blood culture made after this treatment no longer revealed B. proteus. Clinically, sulfanilamide, the authors point out, is effective in the treatment of infection of the urinary system due to Bacillus proteus but under these circumstances it is easier to maintain a high concentration of sulfanilamide in the urine than in blood or in other tissues or fluid.

A few other isolated case reports dealing with meningitis of otitic origin are not included in this review. They, however, bear testimony to the increasing conviction on the part of all otologists that the apparently revolutionary improvement in the result of treatment of these formerly hopeless conditions by chemotherapy has not proved a flash in the pan but is more and more firmly established with the passage of time. It can truly be said that the advent of chemotherapy marks a turning point in otological history which will be looked back upon in years to come as one of the outstanding landmarks in medical history. Doubtless, still newer and more satisfactory forms of individual drugs will be discovered and applied. Likewise, intelligent surgery will still play a part and be required for eradication of the initial focus. Fundamentally, however, it is now firmly established that innumerable lives will be saved by this combination of treatment which in the past have been unavoidably lost.

BRAIN ABSCESS.

Cohen,[19] in a symposium on brain abscess, held at a meeting of the New York Academy of Medicine, discusses late complications of brain abscess, chief among which are personality changes, convulsions and recurrence of the abscess. As exemplifying the first of these, he presented a patient who had developed a left-sided temporal lobe abscess following acute mastoiditis. After primary aspiration and drainage it was necessary subsequently to incise the cortex, insert drainage tubes and packing. The boy ultimately became free of all neurological symptoms but during a subsequent period began to develop a change in personality which was quite obvious to those associated with him. Such a change is more commonly seen with brain tumors but there is usually a return to the normal state following removal of the tumor. Another patient was presented to exemplify the second of the possible sequelae of a brain abscess; namely, convulsions. In this case, convulsions followed recovery from a left frontal lobe abscess secondary to an acute frontal sinusitis. After excision of the scar tissue in the left frontal lobe there was freedom from convulsions for three years but a subsequent recurrence during the ensuing year. In another instance, that of a girl, age 14 years, convulsions followed six years after drainage of a right frontal lobe abscess. Excision of the cerebral scar was followed by cessation of convulsions for a year, after which they returned. Re-exploration of the operative site was undertaken, followed by paresis and secondary disturbance of the left side and continuation of the convulsive seizures. The long period of freedom before the onset of convulsions in both these cases is interesting. Excision of such scars, Cohen points out, is not without some danger since organisms dormant in the scar may lead to flaring up of a meningitis which, however, could perhaps in the meantime be prevented by the prophylactic use of chemotherapy. Recurrence of abscess formation was illustrated by a fourth patient, a woman, age 39 years, who developed a right cellular abscess following an otitis media. Three years later, another abscess in the right cerebellar lobe was drained. Six years later, with the development of similar symptoms, the patient herself made her own diagnosis and was subjected to a third operation for drainage of a cerebellar abscess, since which time she has remained well.

Either a multilocular abscess was present from the start or pocketing was allowed to take place following drainage. The author has no suggestions to make as to the prevention of personality changes or of convulsive seizures. The prevention of recurrences must depend on the thoroughness of surgical care. With removal of the original focus of infection, adequate treatment of a brain abscess should prevent any subsequent recurrence.

In discussing the management of brain abscess of otitic origin, King[20] cites as common locations the cerebrum and cerebellum. Abscesses may be classified as acute or chronic, but from the surgical point of view a true abscess is one which is circumscribed and walled off. The process is at first that of a localized encephalitis, regardless of the mode of entrance of the infecting organism. There is an inflammatory leucocytic infiltration with edema, the surrounding brain substance becomes softened, breaks down and necrosis ensues. The necrotic area liquefies and becomes a small core of pus and detritus contained in an ill-defined cavity without a real wall. About this suppurative focus there is a continued necrosis of brain substance surrounding the irregular, non-encapsulated cavity with the formation of more pus. The cavity is lined with necrotic tags of hemorrhagic brain tissue, beyond which there is a layer of edematous brain substance. Unless limited, the suppurative process will extend to the meninges or ventricle, with fatality. If the protective reaction of the brain be sufficient, accumulated pus is walled off and encapsulated, the edematous area is less and a chronic abscess ensues. Most abscesses are ovoid in shape, the smaller pole directed towards the infected bony cavity from which the infection has spread. Single metastatic abscesses are more likely to be spherical in shape. Abscesses amenable to surgical treatment vary in size from that of a large grape to that of an orange, the size most usually encountered being that of a golf ball or small apple. The thickness of the abscess wall is most commonly about 2 to 4 mm. and requires three to five weeks for formation. The type of organism producing the abscess has some influence on its formation and the amount of resistance offered by the brain. In the presence of anaerobic aneurysm there is little tendency to walling off, but in some instances the wall is so firmly fixed and

resistant as to make the lesion resemble a solid tumor, entire abscesses having been removed as tumors before their true identity was suspected. The abscess content may vary in consistency and in color; it may be odorless or fetid and foul-smelling. The amount varies from 1-2 gm. to over 7 oz. The commonest infecting organism is the streptococcus hemolyticus, though abscesses may be due to pneumococcus, staphylococcus or colon bacillus or a mixture of these organisms, while some abscesses contain sterile pus. Most abscesses resulting from otitic infection locate in the homolateral, temporal or cerebellar lobes, or both, the temporal region being more commonly involved. In cerebellar abscesses, the outer inferior portion of the lobe is more frequently the site of a lesion, which, however, may be central in position. Temporal lobe abscesses, the commonest of these lesions under discussion, are secondary as a rule to otitic infection, recognizable either before or after mastoidectomy. Cholesteatomatous necrosis of the dural plate with dural exposure may be found. The external bony cortex may be hard and acellular, or areas near the dura may be soft and partly destroyed by disease. The pathways of infection spreading from the diseased area in the middle ear may be classified as follows:

a. Necrosis and perforation of the roof of the tympanic cavity with an extradural abscess at times present. The dura becomes adherent to the necrotic area of the bone and to the brain, and infection spreads directly into the brain capsule. Such lesions occur most commonly in patients between 20 and 40 years of age, owing to the thinness and vascularity of the roof of the tympanic cavity in adults. Such abscesses may be connected with the diseased area in the skull by a stalk, and may even perforate the wall spontaneously and discharge large quantities of pus through the external canal.

b. Extension and spread of the infection along the perivascular spaces or perforating blood vessels, in which case the abscess wall is at a greater distance from the meninges which cover the cortex in which there may be no gross changes.

c. Purulent thrombosis of the lateral sinus with subsequent abscess formation in the temporal lobe, a route, however, more commonly the cause of a cerebellar than a temporal abscess.

d. The rarest pathway, via the internal auditory meatus.

Petrositis is more likely to provoke meningitis than brain abscess. In a classical case there occurs following mastoidectomy, most often for chronic middle ear disease, a persistent foul-smelling discharge or a sudden cessation of the latter after a period of time. Patients complain bitterly of temporal pain rather than headache, due to rapid increase of intracranial bulk from suppurative encephalitis and edema. With this pain go loss of appetite, vomiting, usually without nausea, and chills or chilly sensations. Pulse and temperature are at first elevated, prostration is marked, tongue is coated, and the odor of the breath is foul. There is usually no choking of the discs in the early stage and there is absence of high fever, stiff neck and the Kernig sign, which are so characteristic of meningitis. With limitation of the process and circumscription by establishment of a wall, pain diminishes and the patient as a rule becomes lethargic, with a loss of cerebration and development of a dreamy state. Temperature ranges between normal and 100° to 102°, pulse drops to a rate of 45 to 50. Respirations may be lowered but are usually regular, weight loss is rapid, as is the gain on recovery. Contralateral facial weakness is usually relatively mild, and paralysis of the arm is present only with large abscesses or in those with extensive edema. Aphasia is usually present in lesions of the left temporal lobe in right-handed patients and vice versa. It is of the sound memory type rather than motor, the latter indicating a large and extensive abscess. Some paralysis of the oculomotor nerve may be observed, while papilledema may or may not be marked by the time the patient comes to operation. The amount of swelling is not necessarily proportional to the size of the abscess. Visual fields if possible will often be helpful in location of a brain abscess. Lumbar puncture often reveals a clear fluid under a pressure well over 200 mm., the cell count varying from normal to 50-100. Before encapsulation the cells are predominantly polymorphonuclear, afterwards lymphocytes indicate that walling off of the abscess has been complete. King does not believe that slow removal of a small amount (2 cc.) of cerebrospinal fluid for diagnostic purposes is ever followed by untoward results, and may be of some therapeutic value. All combinations and variations in this symptomatology may be seen and there is no single clean-cut syndrome or

clinical picture which is conclusively diagnostic of the presence of a brain abscess. Without operative relief, abscesses may cure themselves spontaneously, may rupture into the meninges or ventricle or cause death from increased intracranial pressure by paralyzing the medullary centres. Diagnosis may be easy, difficult or impossible. In cases of doubt, resort should be had to ventriculograms, since any abscess lending itself to operative interference will produce distortion of the lateral ventricle. Ventriculography is preferable to encephalography; it is safer in an effort to arrive at accurate localization of the abscess. Indiscriminate exploratory punctures or punctures through infected fields are strongly to be condemned. Consideration must always be given to simulating conditions such as serous meningitis, extradural abscess, sinus thrombosis, brain tumor, subcortical hematoma and abscesses in other portions of the brain. Cerebellar abscesses are more frequently found in children and in younger people than adults. They are usually located in the lobe adjacent to the involved mastoid or lateral sinus, are more frequently situated in the external portion of the lobe and are smaller in size than the usual cerebral abscess. As a result of their posterior position, cerebellar abscesses tend to make pressure across the midline, displacing the medulla and brain stem and producing a homolateral compression of the pyramidal tract, with blocking of the aqueduct and resultant internal hydrocephalus. There is marked intracranial pressure, bilateral papilledema and bilateral frontal headache. Nystagmus toward the affected side is often observed. Diagnostic lumbar puncture must be done with great care, and therapeutic lumbar punctures are contraindicated. For relief of pain, ventricular puncture through a burr hole over the homolateral anterior horn should be done in every case. Patients are usually stuporous or in coma but are relieved by ventricular puncture, during which procedure air can be readily substituted for cerebrospinal fluid and ventriculograms made, which will show the degree of dilatation of the ventricle. In executing treatment for brain abscess, all extradural foci should be eradicated, after which many so-called brain abscess pictures will prove to have been due to some other cause, such as extradural abscess. Operation on a true cerebral abscess is best done after the third or fourth week, at which time complete walling off of infection

may be expected. Supportive dehydrating measures should be adopted and blood transfusions and intravenous administration of glucose solution may be useful. King strongly advocates the open method of operating as against that in which drainage tubes or tapping are employed. In the open operation, the overlying bone, dura and cortex are removed over an area about 3-4 cm. in diameter. Most abscesses are situated not more than 2 cm., and frequently less, below the dura. Through the dural opening, necrotic brain and pus outside the abscess cavity, if present, are removed, as well as the presenting portion of the abscess wall. The cavity is then readily evacuated and inspected and secondary pockets detected and dealt with, in a manner impossible by the use of drainage tube, as in the closed method. Slow controlled elevation of the floor of the abscess to the level of the skull obliterates the abscess cavity with prevention of secondary pockets and rupture into the ventricle. Iodoform gauze is used in the cavity and the area well Dakinized until healed, usually in a period of from 35 to 60 days. A subsequent plastic operation, excising the surface scar, may be done after six months. Drainage tubes are used by the author only in cerebellar abscesses where no consideration need be given to the ventricle and where the anterior pole of the abscess is fixed to the infected mucosa by adhesions which could not be separated. Preliminary ventricular puncture should always be done. In a series of 35 patients treated by King by this method, there were four deaths, all in temporal lobe abscess. In no case was more than one operation for brain abscess required, and multiple procedures were never done. None of the patients have had postoperative convulsions except for four in whom convulsions were present before operation. Of the last 20 consecutive patients, all but one have recovered.

Kaplan[21] maintains that patients with brain abscess die as a result of a combination either of meningitis, spreading encephalitis or increased intracranial pressure. Pus *per se* within the cavity of the brain abscess is not responsible for the patient's death, and in patients with well localized, uncomplicated abscesses there is frequent absence of fever, leucocytosis or toxemia. He is convinced that in treatment of brain abscesses, the following four factors are of the utmost importance:

1. Initial and complete removal of the primary focus of infection.

2. Allowance of sufficient time for encapsulation of the abscess.

3. Accurate visualization of the size, shape and location of the abscess.

4. Adequate and free drainage after proper walling off of the subarachnoid space to prevent meningitis.

The author presents the essential details of five cases to illustrate these points.

A case of cerebral pseudoabscess of otogenic origin is reported by Friedman,[22] who suggests that this term should be replaced by the more appropriate one of localized, non-suppurative encephalitis. The case is of interest, first as adding one more to a small series of so-called pseudoabscesses of the brain; second, as indicating that a relatively benign process in the ear with a sclerosing mastoiditis may lead to secondary infection of the brain; and third, as emphasizing the fact that implication of the homolateral IIIrd nerve may be helpful in the diagnosis of lesions of the temporal lobe. Contrary to some observers, the author believes that there is an etiological relationship between the otitic infection and the cerebral lesion. Such pseudoabscesses may develop on the basis of infection with an attenuated virus which gives rise in the brain to signs of a low-grade inflammatory process. Spontaneous healing frequently occurs in such cases, but in the author's case the onset of papilledema made operative interference imperative. The pathway of infection in these cases is probably by way of the tegmen tympani and the venous channels of the surface of the brain.

Solitary autogenous abscesses of the parietal lobe are clinical rarities constituting less than 10 per cent of all abscesses of the brain. Hamby[23] and his coworkers present a most interesting case of a girl, age 8 years, who suffered from a left acute otitis media and a subsequent abscess overlying the left mastoid process but without involvement of the underlying bone. Cultures following incision of the drum revealed a pneumococcus type III, for which liberal doses of sulfanilamide were given. Several months later, the patient again

became ill and after a prolonged illness developed a left-sided paresis involving the lower face, left arm and left leg. Owing to the left-sided otitic lesion, the patient was suspected of having a left frontoparietal abscess but ventriculography indicated compression and displacement of the ventricles into the left side of the skull, pointing to a right-sided lesion. At operation a right parietal osteoplastic flap was turned down and a large, ovoid encapsulated mass was removed, containing creamy white pus. During a somewhat stormy convalescence, the patient was treated with pneumococcus type III rabbit serum and by liberal doses of sulfanilamide. Convalescence was complicated by the development of a cerebral hernia which ultimately subsided without fragmentation. Neurologically, there was still spasticity of the left extremities. The case is unusual in that the abscess was contralateral to the frank otitis media, though there probably existed a subclinical form of otitis in the ear on the same side. Spinal fluid changes were at a minimum owing to the degree of encapsulation of the abscess. The path of infection in such instances may well be a vascular one by way of the venous sinuses. Since, however, in this case there were no evidences of metastatic infection, one must conclude that the ipsilateral ear infection was the point of origin of the abscess, any vascular route being extremely circuitous. The authors believe that in this case the spread of infection towards the meninges was prevented by the combination of specific antiserum and sulfanilamide. It is apparent that from now on, otological literature is likely to contain more and more reference to the use of chemotherapy in the treatment of brain abscess as well as meningitis, though fundamental intelligent surgery will always be required in handling this type of complication.

The case report by McDougall[24] is testimony to the effectiveness of such chemotherapy in treatment of a temporosphenoidal brain abscess. The patient, a school girl, age 11 years, was operated upon for acute suppurative mastoiditis, at which time a large temporosphenoidal abscess on the right side was discovered and evacuated. Treatment consisted of daily spinal punctures, administration of sulfanilamide and sulfapyridine and transfusions of whole blood at 2-3-day intervals, supplemented by 5 per cent glucose intravenously

at 8-12-hour intervals. Ultimate complete recovery occurred and the author feels that chemotherapy had much to do with the outcome in this case. Diagnosis was not made until the time of operation.

Altmann[25] calls attention to the fact that, although commonly cited as one of the most frequent symptoms of abscess of the temporal lobe, aphasia is not by any means definite proof of the presence of such an abscess, even in the presence of acute or chronic suppuration of the middle ear. Other intracranial processes, such as otogenic, extradural and subdural abscesses, localized meningitis and tumors, meningiomas and, particularly in children, solitary tuberculomas of the temporal lobe, may also produce aphasia. This differentiation is important, since after discovery of an extradural abscess one may be uncertain as to whether this alone is sufficient to explain an aphasia or whether further investigations of the cerebral cortex, undesirable as it may be, should be undertaken. Such aphasia has repeatedly been reported to have disappeared after drainage of an extradural abscess but this will not necessarily always follow. The mechanism of production of aphasia is frequently one of intracranial pressure but in certain instances an extradural abscess so small as to preclude the causation of pressure will, nevertheless, be found to be the cause of aphasia. The author reports two cases in which aphasia was found to be due to extradural abscess in the absence of actual subcortical infection.

It has always been a moot question whether a cerebral abscess should fall more properly under the care of a general or neurological surgeon than under that of the otologist. Not all otologists are trained neurological surgeons and, on the other hand, few general or neurological surgeons have had fundamental training in otology. An interesting controversy over the subject is presented by Herrmann,[26] himself an otologist, who feels that the general surgeon often fails to take into account the more particular otological fundamentals which operate so frequently in determining the characteristics of an otitic brain abscess. He stresses the importance of a specialized examination of the tympanic membrane, which many general surgeons readily overlook. Of great importance is operative procedure on the mastoid at the proper time, neither too early before some degree of localization has

occurred, nor too late after the infection has become chronic. Herrmann strongly disagrees with the opinion held by his controversial surgeons that with every opening of the mastoid process the lateral sinus and dura should be uncovered. He feels that in some instances exposure of the sinus leads directly to formation of a thrombus and sometimes to severe hemorrhage. Differences in technique of drainage of a brain abscess are permissible so long as the essential point is kept in mind of providing the most favorable drainage for the abscess. In particular, the author disagrees with the general surgical point of view that the appearance of spinal fluid in an abscess cavity is an indication that the abscess has broken into the ventricle. This finding in reality points to the fact that the wall of the ventricle, under diminished pressure, has broken into the abscess cavity. Such a rupture of the ventricle is not necessarily fatal, and if the bacteria happen to be of a low degree of virulency the ventricular rupture may indeed be helpful in irrigation of the abscess cavity. Naturally, however, such ruptures should if possible be avoided. To this end the author recommends lumbar puncture or puncture of the cistern or ventricles before drainage of the abscess in order to reduce the ventricular pressure and thus to prevent possible rupture of the ventricle. The author reiterates the importance of some otological knowledge on the part of any physician or surgeon who undertakes the care of otogenic brain abscess.

LATERAL SINUS THROMBOSIS AND SINUS THROMBOPHLEBITIS.

A comprehensive and interesting discussion of many of the clinical problems associated with infectious lateral sinus thrombophlebitis is to be found in a panel discussion conducted by several prominent clinicians under the chairmanship of Dean.[27] Due to the fact that, etiologically, sinus thrombosis may in some 15 or 20 per cent of the cases be due to some other organism than the hemolytic streptococcus, Hartmann feels that in the utilization of chemotherapy, sulfathiazole or sulfapyridine is the drug of choice, given in an amount that will insure a blood concentration of from 5 to 10 mg. per 100 cc. This means administering about 0.2 gm. per kilogram of body weight or a grain and a half per pound per day, with half this dosage given as the first dose. With

any risk of vomiting by mouth, the drug had best be given parenterally. With sulfanilamide, this may be given in one-half or 1 per cent solution, intravenously or subcutaneously. With sulfapyridine or sulfathiazole, one is restricted to the use of sodium salt (5 per cent) intravenously, though either may be given in more dilute solution subcutaneously. If time establishes the existence of a hemolytic streptococcus infection, one may switch to sulfanilamide, particularly because of the ease of its parenteral administration, subcutaneously or intravenously. Due consideration must always be given to other factors, such as dehydration, acidosis and anemia.

Law brings up the point that allowance must be made in the interpretation of mastoid X-rays for previous administration of chemotherapy. There is an increased transparency or diminution of opacity in the serum as compared to one in a case in which the drug has not been administered.

Furstenberg discusses utilization of sulfanilamide as a local therapeutic agent in the form of powder instilled into mastoid and other wounds, apparently with considerable benefit to rapid healing and the prevention of secondary infection. This form of treatment, permitting rather more complete closure of the mastoid wound, seems also to be beneficial in promoting resolution in the middle ear, with discharge of the patient from the hospital with a closed wound often 10 or 11 days after operation. Irrigation of mastoid wounds has also at times appeared to be beneficial, a 1 per cent solution of sulfanilamide in physiological saline solution being helpful. If the initial organism were the pneumococcus, then sulfapyridine would likewise be used locally.

Lillie feels that the use of sulfanilamide and sulfapyridine may readily mask signs of acute mastoiditis and should be reserved for complications of mastoiditis rather than for the initial infection. In the event of the development of possible intracranial complications, he feels that the drug should be stopped and the course of the patient watched without this complicating factor. [Editor's note: A considerable portion of the ensuing discussion by members of the panel covered a number of clinical factors with respect to the administration of chemotherapy in the treatment of otitic complications, quite apart from any direct connection with lateral sinus

thrombosis. The reader will find such discussions of interest as exemplifying the thought of some of America's leading otolaryngologists, but the nature of the discussion is such as to make any concise resumé almost impossible.]

The panel continues with a discussion of papilledema and its relationship to sinus thrombosis. Friesner mentions a summary over a 10-year period, in which he observed 25 cases of papilledema, in none of which there occurred a secondary atrophy of the optic nerve. He doubts the clinical significance of papilledema since in the group of 25 cases there was a mortality of only 4 per cent, and there appeared to be no parallelism whatever between the lesion and the clinical course of the disease. Jugular ligation frequently did not appear to contribute in any way to the increase in the circulatory embarrassment of the fundus, the papilledema being due neither to venous embarrassment, intracranial pressure or toxicity alone, but to some combination of these things. Dean noted that over a period of 25 years, in almost all cases in which packing of the lateral sinus had been necessary for hemorrhage, evidence of papilledema from blocking of the circulation was seldom, if ever, noted. On the other hand, Lillie reported having noted papilledema following operation on the lateral sinus and jugular vein, which he attributed to interference with the normal circulation of the inferior petrosal sinus. Hartmann cited his experience with papilledema which was found in 14 of the 34 cases in which it was looked for. He noticed that all cases of papilledema had positive Queckenstedt tests but not all with positive Queckenstedt tests had papilledema. However, all patients with bilateral positive Queckenstedt tests had papilledema, and in one instance blindness developed as a result of optic neuritis which went on to atrophy. Lillie comments on the rarity of cerebellar abscess in connection with sinus thrombosis, having seen only one such in his experience. On the other hand, in contradistinction to direct adjacent infection, one may readily have a metastatic abscess secondary to such a sinus thrombosis, just as one may have abscess in the lung or in a joint. Dean mentioned only two cases of such cerebellar abscess secondary to lateral sinus infection in an experience of 40 years. Law mentioned the impossibility of recognizing a clot in a thrombosed sinus by X-ray. The X-ray

itself does not show the sinus but only the groove through which it passes. A clot, therefore, would be no more obstructive to the ray than would blood, so that one cannot depend on X-ray to diagnose sinus thrombosis.

There follows in this panel an interesting discussion by Furstenberg on anatomical variations of the lateral sinus illustrated with appropriate drawings showing some of the unusual and abnormal configuration which may occasionally be encountered and which, unless recognized, might readily throw the otological surgeon far off the track. The lateral sinus may be divided into two portions, it may be absent on one side, and various unusual relationships may exist between the lateral sinus itself and the normally small branches such as petrosal and emissary veins. The varieties are distinctly reminiscent of the anatomical variations to be seen in the system of biliary ducts and their relationship to the gall bladder.

Hubert[28] cites an interesting case of a girl, age 12 years, who, since the age of 4 years had suffered from a right chronic aural discharge. In April, 1938, she was treated for what was suspected to be a furuncle of the canal, but with further complications and evidence of stomach involvement, she was finally operated upon, and upon exposure of the lateral sinus, the latter was found to be necrotic and completely thrombosed. Cholesteatoma was found to have invaded the middle ear and hence the jugular vein was ligated, in spite of which the subsequent course was extremely stormy. At no time were blood cultures positive in spite of repeated chills, with high fever, at one time up to 108°. The organism recovered from the mastoid wound was a hemolytic streptococcus. After treatment by chemotherapy and repeated blood transfusions, patient ultimately made a complete recovery, an outstanding feature of which was the unusually good hearing retained in the ear on the operated side. The author feels that resistance of the temptation to operate the second time upon the lateral sinus was an important factor in the girl's recovery and that confidence in the effectiveness of chemotherapy was one of the outstanding points on which decision to withhold further surgery was made.

An interesting contribution to the treatment of sinus thrombosis is that made by Erodi.[29] He points out that very

often when clinical sinus thrombosis is suspected, there is, nevertheless, no grossly demonstrable thrombus at the time of exposure of the jugular vein. He feels, nevertheless, that the checking or retention of such a lesion depends entirely on exclusion of the infected area from the general circulation, first by ligation of the jugular vein; second, by the development of a thrombus; and third, by the removal of this thrombus by incising the sinus wall and curetting out the infected thrombus. Hence, it is undesirable to wait for the development of such a thrombus during which period extensions to smaller tributaries may take place. He advances the interesting suggestion of the artificial production of a thrombus at the site of the suspected sepsis. He, therefore suggests the exposure of the sinus wall, ligation of the jugular vein and the application directly to the sinus wall of tincture of iodine. Experimentally, it has been found that application of this medication to tissues tends to the development of sclerosis, and in the case of a blood vessel to the formation of a sterile thrombus. The development of this thrombus checks the extension of the infection, and once the thrombus itself has been formed, the vein may then be safely opened and the thrombus eradicated. In one instance following the development of sinus thrombosis secondary to a skull fracture, the author carried out this technique of the application of tincture of iodine to the sinus wall with complete success and feels that, although no conclusions can be drawn from such a limited experience, the method is worthy of consideration and deserves a trial. One distinct advantage provided by this thrombus formation is the avoidance of severe hemorrhage, which might otherwise take place when the wall of the vein is prematurely incised.

Druss[30] reports the instructive case of a boy, age 5 years, who suffered from acute mastoiditis, for which a simple mastoidectomy was performed. Exposure of the lateral sinus revealed nothing abnormal, cultures being returned as Streptococcus hemolyticus. Though initial blood cultures were negative, the patient on the fourth day developed a metastatic focus in the left hip. This finding justified ligation of the jugular vein and exploration of the lateral sinus, the wall of which showed some phlebitis but with free bleeding from both the jugular and the torcular ends. Patient

remained critically ill and was thought to be suffering from a vitamin B deficiency, which responded favorably to the administration of both vitamins B and C. On the twenty-seventh day in the hospital, patient developed a severe agranulocytosis, presumably from the continued therapy, which was thereupon stopped and replaced by daily transfusions. In view of the continued evidence of sepsis, the sigmoid sinus was re-explored with essentially negative operative findings. A pronounced stiffness in the neck was ultimately proved due to a large retropharyngeal abscess, incision of which evacuated a considerable amount of thick, creamy pus. Ultimately the left hip joint was aspirated and found to contain thick, purulent exudate. After repeated blood transfusions, blood cultures ultimately became sterile and the patient made a satisfactory recovery. The author points out that, although the initial blood cultures were sterile, upon the development of a bacteremia, the latter persisted for a period of at least 41 days. The agranulocytosis was a particularly disturbing element, appearing at the end of 19 days after the drug had been started, during which time the patient had received a total of almost 1,500 gr. of sulfanilamide. Fortunately, immediate discontinuance of the drug and administration of blood transfusions brought about a rapid regeneration of the white blood corpuscles. All told, the patient underwent four major operations and received 16 blood transfusions, totaling almost 4,500 cc. of blood.

Harkness[31] gives a thorough and comprehensive resumé of the present status of our knowledge of phlebitis and thrombophlebitis of the lateral sinus. He feels that diagnosis is not a simple matter and depends upon such a variety of data as the clinical signs, temperature, pulse, presence of chills and general septic condition and blood cultures, fundus findings, manometric readings and lumbar puncture. The indications for sinus surgery depend rather more on general than on local conditions which may be most deceiving. A simple phlebitis may require blocking of the sinus more than does a walled off and possibly sterile thrombus. Differential diagnosis between phlebitis and a true thrombus is oftentimes practically impossible. The type of mastoid infection has a profound influence on subsequent pathology and the indications for therapeutic intervention. There is less tend-

ency today to consider sinus involvement as an emergency and to recognize the value of thorough study of the clinical picture before decision to operate. Supportive and medical treatment have assumed greater importance since the advent of chemotherapy. Consistent reasoning advocates, first of all, a mastoid operation and then subsequent close observation of the clinical course and, finally, sinus surgery and possibly jugular ligation if it seems necessary. The day of primary ligation of the jugular vein prior to any sinus surgery has passed. With the advent of chemotherapy, it is becoming more and more logical to reserve ligation for those cases in which other measures fail to bring success. Postponement of ligation until, as a result of thrombus formation, some degree of collateral circulation has developed has some desirable advantages. In his discussion of Harkness' article, von Lackum offers the following summary of procedure with respect to treatment of suspected sinus thrombosis:

A. Positive signs for sinus surgery are: *1.* bacteremia, especially if repeated; *2.* temperature course with chills and quick remissions; *3.* high white blood count with the Schilling shift to the left; *4.* pulse out of proportion to the temperature; *5.* a patient who looks acutely ill, suffering from sweats and with a clammy skin; *6.* failure of medical treatment to achieve results after a reasonable time, especially since the advent of chemotherapy; *7.* positive findings in the eyegrounds.

B. Rational surgical procedures: *1.* in a pulsating sinus, being strongly suspicious of thrombosis, one should *2.* carefully explore the mastoidectomy if already done, determine if it was completely executed, recognizing that the proper mastoidectomy is not a simple but a complete one; *3.* exposure of the sinus as far as the extent of pathology; and *4.* packing and draining surgically.

C. Ligation. *1.* Ligation of the internal jugular vein is indicated if the clot is not firm, or if symptoms do not subside, ligation may be performed a few days later. *2.* Even in the presence of bilateral ligation, collateral circulation will re-establish itself. *3.* Ligation, of all procedures executed on the sinus, is possibly the least essential.

D. Actual procedure. *1.* Occluding plug should be removed in six days. In the presence of profuse bleeding, packing

over the sinus wound should be done with the mastoid wound wide open. *2.* Regular blood transfusions if necessary. *3.* Chemotherapy.

E. Prognosis. *1.* Cases seen early in the disease usually give a more favorable prognosis. *2.* Extension by direct continuity will give a more favorable prognosis than by thrombosis of small veins. *3.* The presence of metastases gives an unfavorable prognosis.

Schmitz, in the same discussion, stresses the differential results between the ultraconservative and those who adopt conventional routine jugular ligation. He cites Mygind, who reported a series of cases with 71 per cent recoveries, with no more surgery than a simple mastoidectomy. The lateral sinus was not opened and the jugular vein was not ligated. Northrop, on the other hand, reported metastasis in 44 of 161 cases, all of which were ligated. To date, the mortality rates are practically the same in the hands of most capable men, regardless of divergent opinions as to proper procedure. One is between two fires with respect to early operations in which mechanical interference with Nature's effort to wall off occlusion may precipitate undesirable complications and, on the other hand, with the fact that in slow-forming, coalescent infection, delayed operation may result in necrotic softening of the sinus with perisinus infection and pathology of the vessel wall. In suspected mastoiditis, surgery should be delayed until the third or fourth week wherever possible. He quotes Kopetzky as reporting that 25 per cent of the latter's cases showed evidence of perisinus infection at the time of the original mastoid operation. The discussor sees no reason to dispute the practice of simple tight gauze packing at both ends without ligation after inspection of the sinus lumen. Postoperative reaction is less stormy than in cases in which ligation is practiced and there is less interference with collateral circulation. Frank anterior bulbar extension of the thrombus with a tendency to break down and provoke ascending infection certainly justifies jugular ligation, though the resulting retrograde extension of the infection may account for a certain percentage of the mortality existing. Schmitz feels that the bacteriostatic action of chemotherapy should reduce the incidence of metastasis, infective phlebitis and thrombophlebitis where the offending organism is the

streptococcus. Sulfapyridine combined with specific serotherapy may prove equally effective with pneumococcic infections. Neither would be of much value in a walled off focus of infection which requires local surgical treatment for its eradication.

In reporting a case of thrombosis of the lateral sinus and abscess of the temporal lobe due to Bacillus proteus, Dearman and Sims[32] stress the following points: *1.* the site of infection involving the Bacillus proteus is usually a chronically discharging ear, the bacillus acting as a secondary invader in most instances. *2.* The vascularity of the field is such as to make it particularly inviting to this organism, with the result that perisinus abscesses and lateral sinus thrombosis are frequent. *3.* The course in these cases is extremely progressive, with possible resultant meningitis and abscess of the brain, as illustrated by the author's case. At the operation the antrum was found to contain cholesteatoma and foul-smelling pus, necessitating conversion of the cavity into a radical mastoidectomy. Both middle and posterior fossae were widely exposed, the lateral sinus was found completely necrosed and at some point apparently organizing, so that free bleeding could be obtained only at the torcular end. This was controlled by cotton pledgets used as packing. The dura was gray and covered with unhealthy granulations. Because of the aphasia and partial paralysis of the facial nerve, the dura was incised; at a depth of 2 cm. a large abscess of the temporal lobe was found, from which approximately 30 cc. of thin, foul-smelling pus was released. No stalk for this abscess could be found and a self-retaining catheter was inserted as a drain, the wound being packed wide open with iodoform gauze. The patient made an ultimately satisfactory recovery. Cultures from material obtained from both the mastoid and the brain abscess showed Bacillus proteus. Recovery is attributed to removal of the infected tissue, complete, open drainage of the involved field and supportive care given the patient postoperatively.

The essential pathological features of all types of thrombosis, thrombophlebitis and suppurative thrombophlebitis, together with periphlebitis, are discussed from the general surgical standpoint by Bancroft.[33] This article is of the utmost importance for the laryngologist, due to the fact that

in the discussion of therapeutic measures there is an excellent resumé of the present status of therapy in vascular thrombosis by the use of the drug heparin, to which more and more references are being and will doubtless be made in the literature. Being an anticoagulum, it is proving of great value in the prevention of subsequent thrombosis at the site of any vascular damage, trauma or repair. The drug must be administered intravenously in physiological solution of sodium chloride over a period of three to five days as a prophylactice measure to prevent thrombosis. Its chief disadvantage is an economic one, since it costs about $8.00 a day and requires the constant attention of nurses to be sure that the saline solution is running and that the needle does not become dislodged. The author quotes Bowie as reporting that pulmonary embolism, a common surgical complication, occurring in 15 per cent of 300 cases of acute thrombophlebitis, was not present in 81 cases in which heparin was used. In five cases of migrating thrombophlebitis, symptoms disappeared more slowly than it did in cases of the more acute form of the disease. In 29 cases in which an initial embolus had already formed, the prompt administration of heparin prevented the appearance of any further emboli. Heparin is at present apparently being used with considerable success in the treatment of malignant endocarditis, a formerly almost hopeless condition due to the streptococcus viridans. The implications in the general findings in the use of heparin for the otologist are obvious. The possible prevention of lateral sinus thrombosis in early phlebitis is a most intriguing idea and already there have been reports of cures of well established cavernous sinus thrombosis by the utilization of this drug. Bancroft feels that in septic thrombosis occurring in association with otolaryngological conditions, chemotherapy should be combined with heparin, the latter itself having no antiseptic action and as such little effect unless combined with chemotherapy. However, the combination of the sulfanilamide group and heparin should be helpful in prevention of the spread of such emboli and in the stabilization of the clot when it is impossible or inadvisable to perform proximal ligation.

Mention should be made of the always excellent review by Kopetzky[34] of the progress in otolaryngology, particularly as

it concerns purulent otitis media, mastoiditis, sinus thrombosis and suppuration of the petrous pyramids for the year 1939. For this reviewer to review this review would be not only repetitious but an attempt to summarize an adequate summary, for which there is no purpose. Many of the articles reviewed by Kopetzky were covered in the present reviewer's summary in the September, 1940, number of THE LARYNGOSCOPE.

An article by Ormerod,[35] in which he summarizes a paper in Italian by Turtur, is of interest chiefly because it describes some unusual experimental work in an effort to throw some knowledge on the formation of thrombophlebitis of the lateral sinus. Experiments are described in which the wall of the sinus was cauterized to give rise to a mural thrombus. Septic material was applied to such a damaged wall and the clot became infected. Septic material was applied to a non-cauterized sinus wall and a clot produced in about 24 hours. In some instances, however, pyemia occurred without formation of a clot, evidently by the passage of the organism straight through the wall into the blood stream. The author concludes that from a therapeutic standpoint the clot within the vein should always be removed but that it is rarely necessary to ligate the internal jugular vein except in the presence of signs of pyemic infection.

PETROSITIS.

Considering the extraordinary interest which the first articles on the surgical approach to the petrous pyramid produced some three to four years ago, it is rather surprising, in surveying the literature of the past year, to note the extraordinary paucity of articles dealing with this clinical entity. This situation may possibly result from the decreased incidence of this complication following greater use of chemotherapy or possibly from the recognition more and more of the fact that the more thorough the initial mastoid surgery, the less likely will be secondary extensions into more deeply seated portions of the temporal bone. Moorehead,[36] in an article on suppuration of the petrous pyramid, presents three cases, in all of which the infectious process had ruptured through the cortex, forming a subdural abscess, and in two of which there were signs of meningeal irritation. All

patients recovered. The author feels that the Roentgenogram is a valuable aid to diagnosis but stresses the fact that a positive finding does not indicate operative interference any more than a negative one excludes it. Only when taken in conjunction with all the signs observed by other means are Roentgenograms of value. They should be taken from the three usual angles, each angle acting as a check against the other. Every effort should be made if possible to see whether the clinical process is advancing or subsiding. This necessitates careful daily study of the patient, but even under these conditions signs of meningeal irritation may suddenly appear. The exact site of a suppurative process in the pyramid is often difficult to locate and there is no method by which this can be accurately done. From an operative standpoint, it is agreed that no single procedure is suitable for all cases. When pyramid signs are present at the time of invasion of the middle ear, a simple mastoidectomy should be performed and a careful search made for tracts at the time of this procedure. Results should then be observed before further surgical intervention is attempted. Many patients recover spontaneously after simple mastoidectomy. The author still advocates his approach to the pyramid along the floor of the middle fossa with avoidance of a radical mastoidectomy. This affords adequate drainage of the infected focus and leaves an intact middle ear, with preservation of good hearing. The objection that this procedure leads to tearing of the dura during its elevation or while draining the focus along the dura is theoretical rather than practical, and no bad results in any case have been observed which could be ascribed to this method of approach.

In discussing the general subject of petrositis, Wails[37] draws the following conclusions: *1*. A complete simple mastoidectomy will eliminate most petrositic complications if performed early enough. *2*. The petrous tip should be reached along the posterior inferior surface if the inner ear is not infected. *3*. If the inner ear is affected, the petrous tip should be approched through the cochlear portion when the labyrinthitis has become latent. *4*. Symptoms of Gradenigo's syndrome may not be present but if so indicate a late phase of the disease. *5*. Halisteresis or loss of calcium salts in the tip is a late result. *6*. After complete operation for acute mas-

toiditis, continuation of fever after two weeks should call for more careful examination for suppuration in the apex of the petrous pyramid.

An exacting and painstaking study of the histology of the petrous pyramid of the temporal bone is presented by Lindsay.[38] It is illustrated by a large number of photomicrographs and comprises a thorough anatomical classification of the cellular groups which go to make up the petrous pyramid itself. These have been correlated with the Roentgenological views of this portion of the temporal bone and help to interpret the Roentgenogram in the light of the anatomical study. Such an article lends itself only with difficulty to any valuable condensation and must be carefully studied in detail to afford intelligent appreciation of it.

Harkness[39] calls attention to the frequency of the clinical triad seen in petrositis of postocular pain, late sudden increase in aural discharge, and involvement of the VIth nerve. He feels that pain referable to the Vth nerve, which occurs late when recovery has all but taken place, is more significant than pain immediately after a mastoidectomy. While VIth nerve involvement is significant, its absence means nothing. As in the mastoid, the pathological lesion in petrositis may be predominantly an osteomyelitis, an osteitis or a combination of the two. While information gained from the Roentgen ray examination may be invaluable, it does not of itself indicate operative intervention. As in the mastoid cavity, the differentiation between congestion and dissection of tissue is not always easy. Unquestionably, petrositis frequently occurs and is followed by recovery without operative intervention. The author calls attention to Myerson's report that 80 per cent of patients recover spontaneonsly under conservative treatment. In by far the greater number of cases, petrositis is manifest only after a mastoid operation. In the presence of symptoms suggestive of involvement of the petrous bone, a mastoidectomy is indicated and if previously performed should be revised, with a careful search for a fistula or a diseased tract of cells. Conservatism should be the rule, and failure to recognize indications for surgical treatment is better than to subject the patient to the hazards of operation on the petrous bone for insufficient signs and symptoms.

An excellent outline, helpful in the determination of the nature of any postotitic complication, is offered by Rott.[40] He recommends, first of all, searching for or at least recognizing signs and symptoms which might suggest some intracranial complication. The second step is decision as to the presence of some intracranial complications or whether the suggested symptoms are explainable on the basis of some less serious complication. The third step is the determination of the structure involved, and the fourth the establishment of the nature, location and extent of the lesion. Finally, it is important to know whether more than one condition is present. Finally, the otologist seeking answers from the history, from the general and neurological examination and, finally, from operative findings must ask himself, first, "Is an intracranial complication present?" Second, "Is it a sinus phlebitis?" Third, "Is it a nonsuppurative phlebitis?" Fourth, "Is it an abscess and if so where is it located?" Fifth, "Is it a meningitis and if so in what stage?" Sixth, "Is more than one intracranial complication present?"

An extremely interesting and important consideration of those otological complications which may be marked by convulsions is reported by Asherson.[41] He points out that focal, unilateral Jacksonian or generalized convulsions, associated with established aural suppuration, are always due to cortical irritation whether *1.* from outside the cortex, as in extradural, subdural or subarachnoid suppuration or abscess, or from a cortical thrombophlebitis; or *2.* from extension toward the cortex of an intracerebral abscess such, for instance, as in the temporal lobe. Convulsions develop under a number of conditions in association with suppurative otitis. They may be generalized or focal. Convulsions may occur at the onset of an otitis media in instances when the condition is due to what is termed meningismus, a reflex irritative cerebral phenomenon without actual inflammatory cerebral, cortical involvement. A convulsion might also be due to an acute otitic hydrocephalus diagnosable only after lumbar puncture and recording of the pressure of the cerebrospinal fluid. Convulsions may be due to suppuration within the cranial cavity or the brain of otogenic origin. They may arise from: *1.* an encephalitis (otogenic, nonsuppurative), usually a clinical rarity; *2.* an extradural abscess; *3.* a subdural

abscess; *4.* a temporal lobe abscess with extension to the cortex; *5.* otitic hydrocephalus; *6.* otogenic meningitis. A convulsion may be of otitic origin in the presence of a normal eardrum when due to: *1.* a petrositis; *2.* a posterior ethmoiditis or sphenoiditis; and *3.* a healed otitis media, possibly due to the streptococcus mucosus. The author submits interinteresting case histories, all illustrative of these different classifications of convulsions which illustrate findings in each particular type of pathology.

LABYRINTHITIS.

In striking contrast with the review of last year is the infrequent occurrence of reports on labyrinthitis in the literature of 1940. It is undeniably true that in certain reports on otitic meningitis, the focus of infection lay in the labyrinth, but since the meningitis was the more outstanding clinical entity, it was stressed in the report. Unquestionably, the increased use of chemotherapy is tending more and more to prevent the development of such complications as true suppurative labyrinthitis, as is also greater and greater attention to thorough and complete mastoid surgery at the time of the initial operative interference.

Pollock[42] reports the case of a man, age 35 years, who was operated upon for an acute mastoid infection which had ruptured through the posterior canal wall. Following operation on a very pneumatic mastoid with broken cell walls, recovery was temporarily uneventful until five weeks later the patient developed dizziness, nausea, vomiting, headache, tinnitus, horizontal rotary nystagmus to the opposite side and crosspointing. Caloric test revealed a dead labyrinth on the affected side with 20 cells in the spinal fluid, of which 90 per cent were lymphocytes. Chemotherapy was instituted, with steady improvement up to the tenth day. The patient then suddenly developed a temperature of 104°, severe headache and stiff neck. Lumbar puncture showed 3,500 cells and a culture report of streptococci. In spite of a radical mastoidectomy and opening of the semicircular canal, on breaking through the wall of the promontory, the patient died.

A second case report is that of a man, age 26 years, who had suffered from a purulent discharge of the left ear since

the age of 1 year. At the time of admission to the hospital the patient had developed pain over the left mastoid, with vertigo, nausea and a spontaneous second degree nystagmus to the opposite side. Under conservative treatment, symptoms subsided, all hearing disappeared and a slight facial weakness made evident the fact, in conjunction with rotation tests, that the patient had a good labyrinth. When subsequently seen, the patient still had a foul discharge from the left ear, with complete absence of all labyrinthine responses. In discussing these cases, Glatt feels that in the first case an earlier exploration of the labyrinth might have turned the tide in the patient's favor. The history of chronicity in the second case with mild recurrent attacks of labyrinthitis indicated a better prognosis for the patient. Glatt feels that management of the labyrinth at the time of operation depends on the clinical findings. If the labyrinth is intact, it should be left alone. In the presence of meningeal irritation postoperatively, immediate exenteration of the labyrinth is indicated as the best method of preventing meningeal infection. If, however, at the time of operation, cholesteatoma is found to have invaded the labyrinthine capsule, or if removal of granulation tissue uncovers the labyrinth, then the latter should be exenterated at the same time.

In the same discussion, Brunner makes mention of the decreasing frequency with which labyrinthine operations are now being performed. While chronic otitis media tends to be progressive, chronic labyrinthitis tends frequently to spontaneous healing even in the presence of tuberculosis. Chronic labyrinthitis, therefore, does not so frequently call for surgery. Since acute labyrinthitis is also not a surgical condition, there would appear to be less and less indication for surgery so far as the labyrinth itself is concerned, apart from its rôle as the initiator of meningeal infection. In the presence of labyrinthitis with complications manifested by changes in the eyegrounds, blood count and spinal puncture, there is no question but that thorough operative interference is indicated.

Mention was made at the beginning of this resumé of the presumptive effect of the war on the output of literature dealing with this subject, particularly with respect to articles found in the usual foreign journals. The devastating dis-

traction and restriction on normal scientific work brought about by the war are readily understandable and are so feelingly and ably stated by Kopetzky[24] in his own summary on "Progress in Otolaryngology" that this reviewer cannot do better than to quote directly from his opening paragraph:

"It may be stated that the catastrophe which is afflicting humanity has considerably dampened scientific inquiry and study. Obviously lacking the necessary environmental serenity for thinking medical problems through, observers record findings, leaving correlation and deduction from them to someone else working in a happier time. That men of science are mentally preoccupied with the political fate of their country must be appreciated when one is confronted with the paucity of sound scientific contributions in the year under review."

One can only hope that in the not too far distant future this disturbing factor may be removed and that once again the great minds of medicine in otology and in other fields may once again devote their energies to the advancement of all branches of medical science.

BIBLIOGRAPHY.

1. Lewy, A.: Report of the Chicago Committee on Otogenic Meningitis. *Arch. Otolaryngol.*, 31:227, Jan., 1940.

2. Gilmore, G. B., and Sacks, P.: Pneumococcus Meningitis: A Review of the English Literature with a Report of Two Cases in Which the Disease Was of Otitic Origin. *Arch. Otolaryngol.*, *32*:1007-1022, Dec., 1940.

3. Wyllie, W. G.: Meningitis (with Especial Reference to Use of Sufanilamide and Its Derivatives). *Practit.*, 144:369-378, April, 1940.

4. Carruthers, D. G.: Two Cases Illustrating Principles of Management in Cases of Otitic Meningitis. *Med. Jour. Australia*, 1:194-195, Feb. 10, 1940.

5. Critchfield, L. R.; Simons, L. T.; Emmens, T. H., and Newell, F. W.: Pneumococcus (Type III) Meningitis with Recovery. *Minn. Med.*, 23:247-249, April, 1940.

6. Ersner, M. S.; Myers, D., and Hayes, M. B.: Type III Pneumococcus Meningitis of Otitic Origin; Recovery Following Treatment with Sulfapyridine. The Laryngoscope, 50:302-306, April, 1940.

7. Quirk, L. A.: Otitis Media with Pneumococcus Meningitis, Treated with Sulfapyridine. *Canad. M. A. Jour.*, 43:593, Dec., 1940.

8. Brunner, H.: Pathology and Treatment of Otitic and Rhinogenic Meningitis. *Ill. Med. Jour.*, 77:57-63, Jan., 1940.

9. MacKay, F. H., and Hurteau, E. F.: Four Cases of Pneumococcic Meningitis Treated with Sulfapyridine. *Canad. M. A. Jour.*, 42:463-464, May, 1940.

10. GROSSMAN, A. M.: Pneumococcus Meningitis in Three-Months-Old Infant, with Recovery; Review of 27 Cases of Pneumococcic Meningitis. *Arch. Pediat.*, 57:355-366, June, 1940.

11. FRIST, T. F., and RIPPY, E.: Brain Abscess and Meningitis Caused by Type III Pneumococci — Cure with Sulfapyridine. *Jour. Tenn. M. A.*, 33:8, Jan., 1940.

12. TURNOFF, D.; MARENUS, E. B., and SCHNABEL, T. G.: Pneumococcic Meningitis with Reference to Sulfapyridine Therapy. *Pa. Med. Jour.*, 44:172-175, Nov., 1940.

13. MITCHELL, W. J.; BOWER, A. G., and HAMILTON, P. M.: Use of Sulfapyridine in Streptococcus Viridans Meningitis. *Am. Jour. Med. Scien.*, 200:75-77, July, 1940.

14. LINDSAY, J. W.; RICE, E. C., and SELLINGER, M. A.: Treatment of Meningitis Due to Hemophilus Influenza (Pfeiffer Bacillus); Review of 108 Cases. *Jour. Pediat.*, 17:220-227, Aug., 1940.

15. STEELE, C. W.; GOTTLIEB, J., and BRANN, H.; Chemotherapeutic Procedures in Pneumococcus Meningitis; Fatal Case of Type XIX Pneumococcus Meningitis Treated with Sulfapyridine and Type Specific Rabbit Serum. *Jour. Maine M. A.*, 31:315, Dec., 1940.

16. REID, W. O., and LIPSCOMB, J. F.: Successful Chemotherapy for Hemolytic Streptococcal Meningitis and Pneumococcal Meningitis in Same Patient. *Brit. Med. Jour.*, 1:802-804, May 18, 1940.

17. MENEHAN, F. L.: Prognosis and Treatment of Streptococcus Meningitis. *Jour. Kan. Med. Soc.*, 41:1-5, Jan., 1940.

18. NETER, E., and CHAIT, R. A.: Bacillus Proteus in Otitis Media, Complicated by Mastoiditis, Meningitis and Bacteremia. *Arch. Otolaryngol.*, 32:947-950, Nov., 1940.

19. COHEN, I.: Symposium on Brain Abscess. (a) Late Complications of Brain Abscess. THE LARYNGOSCOPE, 50:1139, Dec., 1940.

20. KING, J. E. J.: Symposium on Brain Abscess. (b) Management of Brain Abscess of Otorhinogenic Origin. THE LARYNGOSCOPE, 50:1146, Dec., 1940.

21. KAPLAN, A.: Symposium on Brain Abscess. (c) Brain Abscess. THE LARYNGOSCOPE, 50:1159, Dec., 1940.

22. FRIEDMAN, E. D.: Case of Cerebral Pseudoabscess of Otogenic Origin. *N. Y. State Jour. Med.*, 40:1385-1388, Sept., 1940.

23. HAMBY, W. B.; SHERMAN, DeW. H.; GREENE, C. W., and WITEBSKY, E.: Otogenous Parietal Cerebral Abscess Due to Pneumococcus Type III; Recovery After Drainage, Specific Antiserum and Sulfanilamide; Report of Case. *N. Y. State Jour. Med.*, 40:627-630, April 15, 1940.

24. MCDOUGALL, W. L.: Temporosphenoidal Abscess (Complicating Mastoiditis) with Operation and Recovery. *Ann. Otol., Rhinol. and Laryngol.*, 49:744-748, Sept., 1940.

25. ALTMANN, F.: Significance of Aphasia as a Symptom of Otogenic Extradural Abscess. *Arch. Otolaryngol.*, 31:819-826, May, 1940.

26. HERRMANN, A.: Ueber den Otogenen Hirnabszess und seine Behandlung (Zugleich als Erganzung zum gleichen Thema von w. Kulenkampff). *Deut. med. Wchnschr.*, 66:824-826, July 26, 1940.

27. DEAN L. W., and Others: Panel Discussion: Infectious Lateral Sinus Thrombophlebitis. THE LARYNGOSCOPE, 50:950-988, Oct., 1940.

28. HUBERT, L.: Lateral Sinus Thrombosis — Unusual Course. THE LARYNGOSCOPE, 50:195-197, Feb., 1940.

29. Erodi, A.: Daten zur kunstlichen Sinusthrombose in der Ohrenheilkunde. *Monatsschr. f. Ohrenheilk.*, 74:344-348, July, 1940.

30. Druss, J. G.: Bacteremia of Otitic Origin; Report of Case Presenting Problem in Diagnosis; Recovery Following Unusually Complicated Course. *Jour. Mt. Sinai Hosp.*, 7:36-38, May-June, 1940.

31. Harkness, G. F.: Phlebitis and Thrombophlebitis of Lateral Sinus. *Jour. Iowa Med. Soc.*, 30:59-65, Feb., 1940.

32. Dearmin, R. M., and Sims, J. L.: Thrombosis of the Lateral Sinus and Abscess of the Temporal Lobe Due to Bacillus Proteus. *Arch. Otolaryngol.*, 32:1098-1101, Dec., 1940.

33. Bancroft, F. W.: Use of Anticoagulants in Cases of Postoperative Thrombosis and Embolism. *Arch. Otolaryngol.*, 32:934-940, Nov., 1940.

34. Kopetzky, S. J.: Progress in Otolaryngology. Purulent Otitis Media, Mastoiditis, Sinus Thrombosis and Suppuration of the Petrous Pyramid. *Arch. Otolaryngol.*, 32:962-993, Nov., 1940.

35. Ormerod, F. C.: (Abstract) The Pathology of Thrombophlebitis of the Lateral Sinus (G. Turtur). *Boll. delle Mal. dell'orechia, della Gola e del Naso*, 57:445, 1939.

36. Moorhead, R. L.: Suppuration of the Petrous Pyramid. *Arch. Otolaryngol.*, 32:845-852, Nov., 1940.

37. Wails, T. G.: Petrositis. *Jour. Okla. M. A.*, 33:1-3, Feb., 1940.

38. Lindsay, J. R.: Petrous Pyramid of Temporal Bone; Pneumatization and Roentgenologic Appearance *Arch. Otolaryngol.*, 31:231-255, Feb., 1940.

39. Harkness, G. F.: Complications of Surgical Treatment of Acute Mastoiditis. *Arch. Otolaryngol.*, 32:915-926, Nov., 1940.

40. Rott, O. M.: Otitic Intracranial Complications: Procedures in Diagnosis. *Northwest Med.*, 39:92-95, March, 1940.

41. Asherson, N.: Convulsions and Postconvulsive Paralysis of Otogenic Origin; Some Clinical Observations and Case Records. *Jour. Laryngol. and Otol.*, 55:7:303-324, July, 1940.

42. Pollock: Two Cases of Labyrinthitis: Society Proceedings, Chicago Laryngological and Otological Society. *Ann. Otol., Rhinol. and Laryngol.*, 49:829, Sept., 1940.

AN ANALYSIS OF SPEECH CHARACTERISTICS IN DEAFENED CHILDREN, WITH OBSERVATIONS ON TRAINING METHODS.*†

DR. WALTER HUGHSON; ANTONIO CIOCCO, SC.D.;
E. G. WITTING, PH.D., and P. S. LAWRENCE, SC.D.,
Abington, Pa.

The general attitude of the medical profession towards the whole problem of the deafened child, whether the handicap be relatively complete or only partial, is one of distinct pessimism. The authors of this paper are in complete accord with the program for prevention and alleviation of deafness in children of school age; however, they do not feel that the problem of hereditary, true congenital or biologic deafness is necessarily a hopeless one. This considerable group of children, whether day or resident pupils in the many schools for the deaf scattered throughout the country, presents a challenge to every American otologist. The problem is a fundamental one. Years will be spent in achieving even slight clarification of its many phases; its solution is even more remote. The sum of apparently insignificant facts obtained by painstaking study must eventually provide a working basis for the alleviation and prevention of this truly disabling, social, economic and psychologic handicap.

Nevertheless, it remains that for the time being, at least, the only aid that can be offered so-called deaf-mute children lies in the field of habilitation; that is, training the deaf-mute children to utilize whatever residual hearing is possessed, and to speak. To this end are dedicated the efforts of the teachers and the schools for the deaf. The results of such efforts cannot, however, be fully appreciated unless some quantitative evaluation of the several methods employed is made. Only after an evaluation of this kind will it be possible to arrive at a more precise criterion of the benefits that these children

*Presented at the Seventy-fourth Annual Meeting of the American Otological Society, Atlantic City, N. J., May 26, 1941.

‡From the Otological Research Laboratory, Abington Memorial Hospital, Abington, Pa., and the Division of Public Health Methods, National Institute of Health, Bethesda, Md., and the Pennsylvania School for the Deaf, Mount Airy, Pa.

Editor's Note: This ms. received in Laryngoscope Office and accepted for publication, June 29, 1941.

can derive from training, and at sound ideas for the development of efficient programs of teaching. With this purpose in mind, the study reported here concerning the speech of children who have received auricular training is presented. The auricular method, as the term is now employed, consists of teaching children to utilize their residual hearing by means of amplified sounds.

Early nineteenth century reports of auricular or acoustic training of deafened children with subsequent improvement in their hearing levels are largely of academic interest. Establishment of the original impairment level could not be accurately made with testing methods then in use and, consequently, reported improvement was, of necessity, a matter only of opinion and not of record. French, English and German otologists reported from time to time — 1761 to 1860 — the effect of auditory response to auricular training. Probably the first mention of such teaching of the deaf in the United States appears in the "Annual Report of the Oral Branch of the Pennsylvania Institute for the Deaf and Dumb," Dec. 31, 1883.[1]

Gallaudet,[2] Currier[3] and Gillespie[4] published reports in the early 1890's of similar efforts but in distinction to the Pennsylvania school's experience their results had been highly gratifying. It is interesting to note that effective results were obtained only in the "semideaf" group, a classification which today would permit a very broad leeway of arrangement. This particular fact must be borne in mind in any critical appraisal of the auricular method before the audiometer became a routine instrument for the measurement of hearing loss.

Goldstein,[5,6] in his two monographs describes in detail the contribution of Urbantschitsch in the early 90's to the general program of auricular training and of his own individual efforts from 1895 to 1920. During this period, purely from lack of methods of precision for the measurement of hearing loss, no data are available relative to any actual change in the hearing level of the "semideaf" or partially deaf child. There is no reason to doubt that these pupils acquired, as a result of such training, certain elements of speech.

In 1936, Guilder and Hopkins[7] drew attention to the importance of grouping children with residual hearing in classes

of individuals with similar hearing losses. Here the physical handicap and not scholastic ability is the deciding factor in the selection. Newhart,[8] in 1937, re-emphasized the importance of this method in relation to the use of group hearing aids in children with a hearing loss of 40 dcb. or more. He stated further, "The use of a hearing device by the child with a handicapping loss of hearing will in the near future probably be as common as is the use of corrective glasses by the child with a visual defect causing an equal handicap." Unfortunately, the four intervening years have not been the measure of the "near future." It may be stated here that this result will never be achieved until public school officers are willing to co-operate more fully in placing these children in schools equipped to give them this highly special type of training. This general thesis could be elaborated almost indefinitely; however, it is felt that the specific data presented below will crystallize the entire subject more thoroughly than any amount of argument could do.

Purely as a matter of record and with no claim to priority, in 1931 there was installed at the Pennsylvania School for the Deaf an electrical group hearing aid used for the instruction of 10 pupils. Since that time the method has been expanded to 21 classes in the year 1940-1941, or about 44 per cent of the Schools' resident population of 540 pupils. A report[9] of the auricular program in the Pennsylvania School for the Deaf, published in *Volta Review*, 1937, is an enlightening document.

Chronologic study of reports of the "Committee on the Use of Residual Hearing of the American Association to Promote the Teaching of Speech to the Deaf" sheds interesting light upon the modern developments of the auricular method of the training of hearing and speech. In the *Volta Review*, 1937,[10] and later in 1940,[11] extensive surveys of data derived from questionnaires are reported in detail. The general average increase in the use of group hearing aids amounted to approximately 60 per cent in 106 schools replying to the inquiry.

The replies to the questionnaires are self-explanatory but it should be noted that questions and answers refer to "goals" the schools hope to achieve, rather than any data in regard to actual achievement. Unfortunately, this fact is apparent in the great majority of all publications dealing with the auricular method. There can be little question that speech can be so

taught with greater facility, but how much greater? The use of the sense of hearing itself is taught, but can it be said that hearing is actually improved? There is not adequate objective evidence available at the present time to substantiate this claim. Undoubtedly sharp issue will be taken with this statement, but the fact remains.

This study provides for the first time a detailed statistical analysis of articulation ability in children taught by the auricular and oral methods. Since auricular training is, of necessity, self-limited, it can have no place in the majority group of deafened children who possess no usable residual hearing. It will be seen that this division of groups can be sharply drawn on a purely audiometric basis. This group of deaf children, whatever the cause of the apparent complete impairment, must still be the chief concern of physicians and teachers alike; however, if the success of the auricular method is fully realized and taken advantage of, the ultimate saving of time and money resulting from this type of training given the fortunate 25 to 45 per cent with residual hearing will result in an important sum of money being made available for instruction of the less fortunate majority.

Before presenting the method of speech analysis, an important point must be emphasized in relation to the physical technique of auricular training. Of itself it is not a separate pedagogical method. It represents no more and no less than the application of standard teaching methods through the medium of scientifically designed and applied modern electrical acoustic equipment. There is no longer place for the use of accordions, flutes, horns or other late nineteenth century sources of sound as it is now possible to apply any one or all of these acoustic stimuli to the deafened ear at accurately measured intensity levels with complete regard to reproduction of any quality desired in the stimulating tone.

THE MATERIAL AND THE TECHNIQUE OF RECORDING AND GRADING SPEECH RECORDS.

The material to be presented was obtained from 366 children or over two-thirds of the annual enrollment of the Pennsylvania School for the Deaf, and includes only the records of those children who had in the previous year, 1939, received an audiometric examination.[12, 13]

The electrical transcriptions were made with a Presto Junior Recorder, Model JS, using cellulose acetate, 12-inch discs. The microphone, which was of the condenser type, was placed approximately six inches in front of the speaker, with its plane vertical and approximately 45° to a line from the face. This tended to reduce, if not eliminate, the overemphasis of sounds which are normally explosive in nature. After receiving detailed instructions, each child read through the list of words listed below once as a trial run. The operator was thus enabled to adjust the volume of the amplifier, which differed with each child. This procedure also familiarized the pupil with the words to be recited.

The words comprising the list read by the child consists of all vowels and consonants in our English language used in as many of their combinations as feasible, consonants being used in both the initial and final position wherever possible. We are indebted to Miss Margaret Bodycomb, of the Pennsylvania School for the Deaf, for the compilation of those sounds into a word list familiar to all pupils whose speech was recorded. It will be noted that the first 10 words are the cardinal numbers, repetition of which tended to provide the proper rate of pronunciation of all the words. The following words were used:

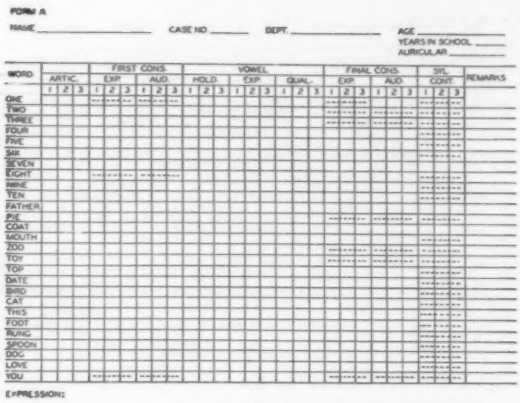
one	father	this
two	pie	foot
three	coat	rung
four	mouth	spoon
five	zoo	dog
six	toy	love
seven	top	you
eight	date	
nine	cat	
ten		

The following sounds are embodied in these words:

a — broad a (father	ō — long o (coat)
ā — long a (date)	ó — short o (rung)
á — short a (cat)	o — broad o (four)
ē — long e (three)	ū — long u (foot)
é — short e (seven)	oi — diphthong (toy)
ī — long i (nine)	
í — short i (this)	

The grading of the speech characteristics in essence consists of the subjective evaluation of how the word, vowel or consonant spoken by the deaf child would compare with those enunciated by a normal hearing child having the same age range and educational level as the former. In order to acquire an adequate foundation for such a comparison, electrically transcribed records were also made on a sample of school children with normal hearing who had not received other speech training than that routinely and indirectly given in the ordinary schools. The records of these children were studied with reference to the same speech characteristics as those investigated in the case of the deaf children, and the criterion of "good" or "normal" was thus obtained.

The form employed in grading the speech records and the speech characteristics analyzed is illustrated in Fig. 1. It is


FORM A

NAME _____ CASE NO. _____ DEPT. _____ AGE _____

YEARS IN SCHOOL _____

AURICULAR _____

WORD	FIRST CONS.									VOWEL									FINAL CONS.									SYL.	REMARKS
	ARTIC.			EXP.			AUD.			HOLD.			EXP.			QUAL.			EXP.			AUD.			CONT.			
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	
ONE																												
TWO																												
THREE																												
FOUR																												
FIVE																												
SIX																												
SEVEN																												
EIGHT																												
NINE																												
TEN																												
FATHER																												
PIE																												
COAT																												
MOUTH																												
ZOO																												
TOY																												
TOP																												
DATE																												
BIRD																												
CAT																												
THIS																												
FOOT																												
RUNG																												
SPOON																												
DOG																												
LOVE																												
YOU																												

EXPRESSION:

Fig. 1.

seen from Fig. 1 that for the words listed the speech characteristics studied are: articulation; explosiveness and audibility of the first consonant; holding, explosiveness and quality of the vowel; explosiveness and audibility of the final consonant; syllable continuity; expression.

The term articulation was employed with reference to whether the word is unmistakably, doubtfully or very badly spoken.

Good: Articulation as good as normal hearing individual or, at any rate, leaving no question as to the word pronounced.

Fair: Recognizable but not without some difficulty, or recognizable even though some of the sounds have been modified.

Poor: Not recognizable as the word, at least upon the first playing of the record.

Though differing somewhat in the description of departure from normal, the various quantitative characteristics of speech are graded in a fairly uniform manner and are easily

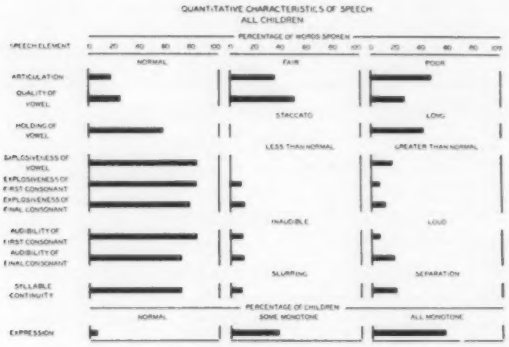


Chart 1.

understandable from Chart 1. Definitions of speech characteristics follow.

Explosiveness is employed as a heading for the classification of the degree of emphasis placed by the speaker on the enunciation of a vowel or consonant. Overemphasis is a well known characteristic of the speech of persons with certain types of deafness.

Audibility refers to the ability of the speaker to pronounce the vowel or consonant so that they are fully perceived by the listener.

Holding serves to head the classification concerned with grading the excellence of the spoken vowel in terms of voicing. Often, due to the method of teaching speech to deaf

children, the habit of prolonging and emphasizing the sound of the vowel is retained.

The term *quality* refers to the pitch characteristic given the vowel. Because of the dependence of the vowel sounds on the predominance of certain of the harmonics of the sound, it is possible to effect marked or slight changes in the quality of the vowel in accordance with the ability of the pupil to imitate the correct mouth, throat and nasal resonance.

The term *syllable continuity* is readily understandable. Just as young children learn words by syllables and often separate syllables unduly, so do the deafened.

Expression is used as a heading for the grading of whether the deaf child has spoken the words *1.* with the same expression as that demonstrated by a normal hearing child; *2.* in a monotone for some of the words; *3.* in a monotone for all of the words.

It is worthy of mention that great care was necessary to preserve the record in order that the subsequent playing would be equal to the first playing in quality of reproduction. The soft surface of the disc used is infinitely more liable to damage than the ordinary hard surface record. Each recording occupied only one-quarter of one side of the disc, which therefore produced very little wear on the needle. However, to avoid any possibility of wear, the needle was changed for each playing and the disc lubricated with a special lubrication fluid which dried upon application, leaving a thinly waxed finish. Special shadowgraphed needles were used throughout, thus eliminating the possibility of tiny irregularities or of extremely sharp needles tearing the record groove. As a test, two recordings were played 50 times under these conditions and no change in reproduction could be noted when compared with a recording played for the first time.

ANALYSIS OF DATA.

Among the 366 deaf children whose speech characteristics are discussed in this report, 248 had never received auricular training up to the time of this recording, while 118 were at the time enrolled in the auricular classes.

In Table I, for all the children and for each of the two groups separately, the frequency with which the speech was found to satisfy the defined gradations is reported relative to the several elements considered. For all the speech elements, except expression, the percentages presented in this and the following tabulations are calculated in terms of all the words spoken by the group of children (or, more precisely, children words). In the case of expression, the percentages are based on the number of children, since the judgment on the degree of expression refers to the performance of the child in repeating the entire list of words.

From Chart 1, and considering all the children together, it is seen, first, that expression is the element for which the deaf children exhibit the most marked deviation from normal. Only 6 per cent of the 366 children could be regarded as having demonstrated a normal speaking inflection or expression, while the majority spoke in a monotone for some or all of the words. With reference to articulation of word and quality of vowel pronunciation, these deaf children also deviate markedly from normal. The articulation was normal in only 18 per cent of the words spoken, and the quality of the vowel was such in about 25 per cent of the words. These children make a better showing with regard to holding of the vowel; 58 per cent of the words were spoken normally in this respect, while 41 per cent were held longer than normal. For the remaining elements examined: explosiveness of vowel, explosiveness and audibility of first and final consonants, and syllable continuity, these children differ remarkably little from normal. In particular it is to be noted that with reference to the pronunciation of the first consonant and the explosiveness of the vowel, over 80 per cent of the words were spoken with normal characteristics. These findings, while they conform in general to the expectations of those experienced in teaching the profoundly deaf, may be regarded as a first quantitative appraisal of the great strides made during the last 50 years in the habilitation of the deaf children and of the direction where further progress is needed. It still remains, however, to overcome the deficiency noted relative to the voicing of vowels and the expression and articulation given the words. It is on methods of training which will overcome these speech shortcomings that apparently more emphasis is needed.

When the speech characteristics of the auricular and oral children are compared, striking pertinent differences are to be observed (see Chart 2). A marked superiority of the auricular children is noted just for those elements that contribute most to the deviation of the speech of these children from normal; *viz.*: expression, articulation, quality of vowel. Almost 17 per cent of the auricular children spoke with good expression, as compared to 1 per cent of those spoken by the oral children. The articulation of the word and the voicing

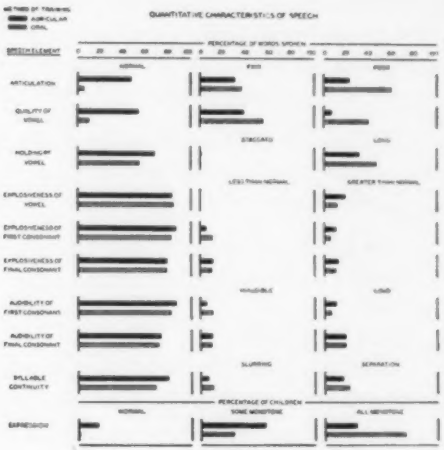


Chart 2.

of vowels were regarded as normal in approximately 50 per cent of the words spoken by the auricular children, but in less than 10 per cent of those spoken by the oral children.

The differences between the corresponding percentages discussed are statistically significant only with regard to explosiveness and audibility of first consonant. For these elements the differences between the two groups are also statistically significant relative to the frequency distributions of the gradations. This is due primarily to a tendency of the auricular group to overemphasize the enunciation of this consonant, while the oral group demonstrates the reverse; *i.e.*, a tendency to underemphasize. This diversity in the speech charac-

teristics of the two groups is apparent also, but to a lesser degree, in the case of explosiveness of vowel and of final consonant.

Summarizing, then, this comparison of the speech characteristics of the auricular and oral groups reveals that for the elements considered, the speech of the auricular group tends more towards that of normal hearing children than does that of the oral group. The superiority of the auricular group is particularly marked relative to quality of vowel, expression and articulation of word, those elements in which the speech of the deaf children is most deficient. Moreover, it is also noted that the auricular children when compared to the oral children manifest a tendency to overemphasize certain elements of speech, the enunciation of the first consonant especially. Although no rigid rules have been formulated to delineate precisely the criterion of selection, it obviously involves an evaluation of the hearing ability which in itself would influence speech learning aside from the method of training. It is well to point this out in order that it will be realized that before any definite conclusion can be drawn regarding the differences in speech characteristics of the two groups of children, the many factors involved in such differences must also be considered.

AUDITORY ACUITY AND SPEECH CHARACTERISTICS.

That the amount of auditory perception still retained by the deaf child will influence his speech characteristics goes without saying, but on this point there are two important questions pertinent to this study which should be considered carefully. The first concerns the comparability of the auricular and oral groups and whether the differences observed above, between them, might not be due entirely to a selection of the children on the basis of hearing ability. The second concerns the effects of sound stimulation, inherent in the auricular method, on children with very little residual hearing. The auditory acuity of these children has been measured with an audiometer and described in the first paper of this series. On the basis of the perception of the better hearing ear, the children have been classified into the following three categories: *1.* those who perceive at any intensity all tones from 128 cycles up to and including 2,048 cycles or higher; *2.* those

who perceive at any intensity only the tones from 128 cycles to 1,024 cycles; *3.* those who perceive no tones at the highest intensity of the audiometer or, at best, only 128, 256 and 512 cycles. This classification is founded on the observation, already pointed out, that in the majority of these children the auditory threshold increases as one proceeds from the low to the high auditory frequencies. This would mean, therefore, that the children who perceive the highest tones also have the lowest auditory thresholds. Consequently, the children who perceive at least 2,048 cycles have the best auditory acuity; those who perceive no tone higher than 512 cycles have the worst.

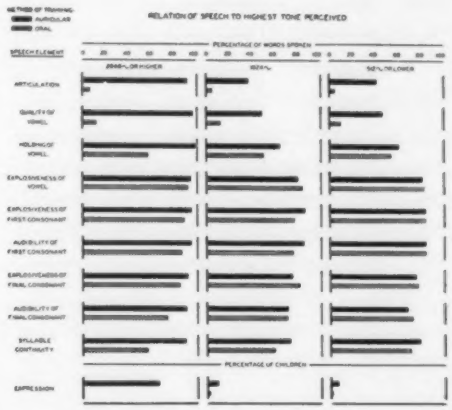


Chart 3.

The speech characteristics of the auricular and oral children whose auditory acuity has been so classified are compared in Chart 3.

Summing up these findings, it appears that the speech of the auricular group of children approaches closer to that of normal hearing children than does that of the oral group under all conditions of residual auditory status. The speech of the auricular children is practically normal for the elements studied when the residual auditory acuity is such that at least 2,048 cycles is perceived. The amount of residual

auditory acuity apparently has little or no bearing on the speech response of the oral children.

AGE AT ONSET OF DEAFNESS AND SPEECH CHARACTERISTICS.

Another factor that will influence the speech characteristics of these children, and particularly the comparison of auricular with oral children, is the time at which the deafness occurred. It is obvious that the later in life a child loses some or all of his hearing, the more speech he will have

Chart 4.

acquired and, consequently, the less difficulty he will have to learn the speech elements normally. This fact is well illustrated by the data presented in Chart 4, in which, from the statements made by the parents,[12] the age of acquisition of deafness has been classified; 0-2 years (includes those born deaf), $2\frac{1}{2}$ to 4 years, $4\frac{1}{2}$ years and over.

Thus, from a study of Chart 4, with respect to the comparison of the two groups, the differences exist independently of the age of onset of the deafness. Moreover, with respect to expression and articulation of word and quality of vowel, the superiority of the auricular group is proportionately greater in the case of the children born deaf (or who acquired deafness before 2 years of age) than in the case when deaf-

ness was acquired after some speech had been learned. For the first three mentioned elements it will be observed from Charts 3 and 4 that even under the most adverse conditions the percentage with normal speech among the auricular children is higher than the corresponding percentage among the oral children in the case of optimum conditions. For example, children in the auricular group whose auditory acuity does not extend beyond 512 cycles and who became deaf at less than 2 years of age are superior in expression, articulation and quality of vowel to children in the oral group who can perceive at least 2,048 cycles and who acquired their hearing impairment after 4½ years of age.

AGE AT EXAMINATION AND SPEECH CHARACTERISTICS.

It is next desired to know to what extent chronological maturation as well as duration of training, affect the speech characteristics of the two groups of children compared and the observed differences between them. The children examined vary in age from 8 to 21 years, with a mean age of 15.3 years. There is a difference in the average age of the two groups compared. The mean age of the auricular children equals 14.5 years and is, therefore, about a year less than the mean age of the oral children, which equals 15.6 years. The oral children being older and since presumably speech ability is better in older children, this finding indicates that the differences observed between the two groups of children cannot be attributed to a greater maturity of the auricular.

In order to study the effects of age and to render comparable the two groups (but at the same time without reducing the numbers too much), each of the two groups has been subdivided into two age classes: under 15, 15 and over. The findings relative to the speech characteristics of the two groups so classified according to age are presented in Chart 5.

These findings would seem to indicate that with age there is progressive improvement in the speech characteristics of these children, with a difference, however, that while for the auricular children the progress is evidently related to all the speech elements considered, for the oral children this progress is not observed for those important elements such as expression and articulation of word and quality of vowel. Since advancing age involves also a longer duration of train-

ing, the influence of this factor must be studied before discussing further these observations.

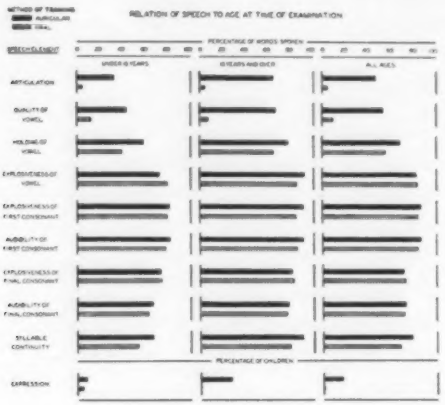


Chart 5.

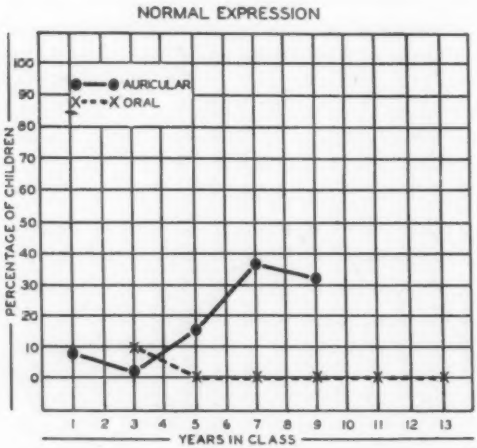


Chart 6.

DURATION OF TRAINING AND SPEECH CHARACTERISTICS.

In Charts 6 and 7, data on the speech of the auricular and oral groups are presented with reference to the duration of

training received by each group. It is immediately seen that the auricular children have, on the average, received less

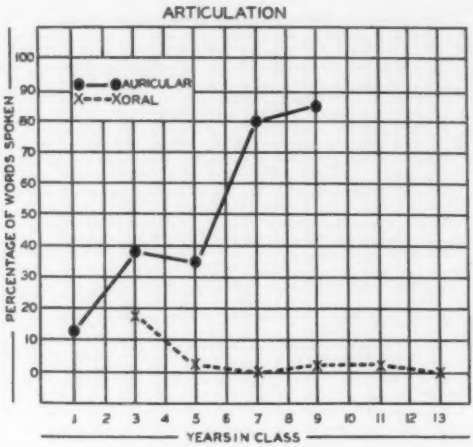


Chart 7a.

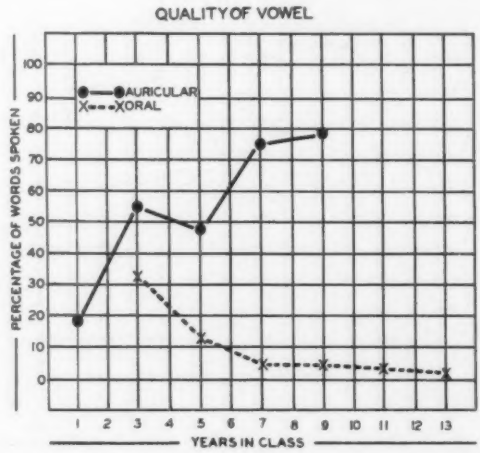


Chart 7b.

training. The explanation of this is that this method of training has been introduced more recently.

From these charts, the progress due to increased training is clearly demonstrated in the case of the auricular group of

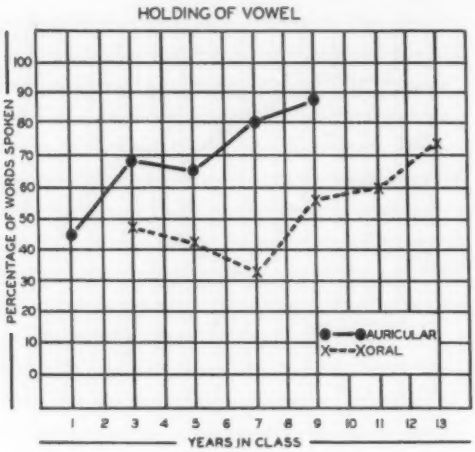


Chart 7c.

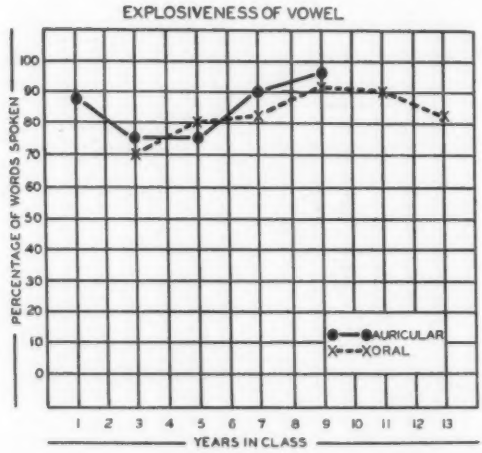


Chart 7d.

children, and particularly relative to those speech elements that are apparently most difficult to acquire by the profoundly

deaf child. The data on the oral children contrasts with those on the auricular children. It appears that for the speech char-

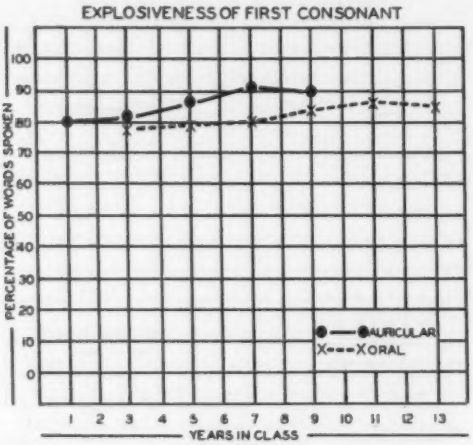


Chart 7e.

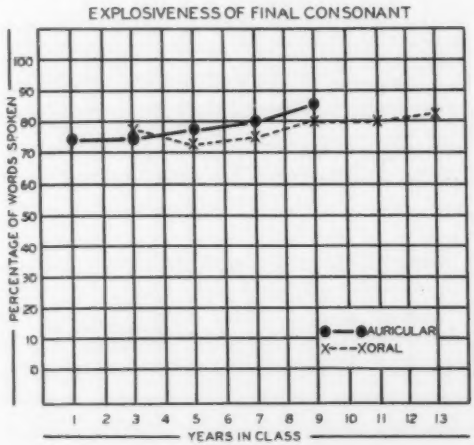


Chart 7f.

acteristics studied there is little progressive improvement with increased training for the oral group. In the case of the

three elements for which the deaf children show the greatest deficiency there would seem to be some retrogression rather

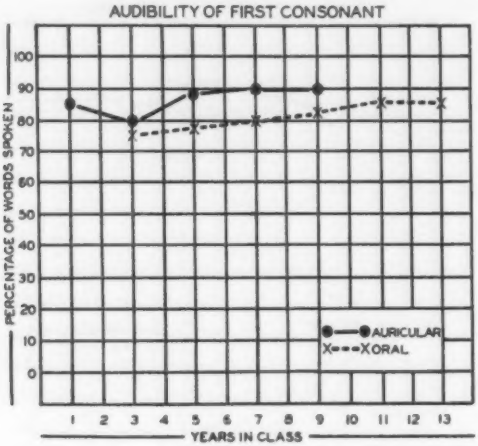


Chart 7g.

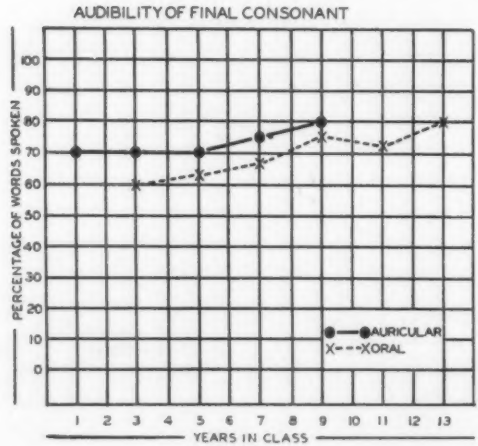


Chart 7h.

than improvement with advancing years. For example, the children having two to three years of training repeated the

words with normal expression, articulation and quality of vowel, respectively, in 10, 18 and 34 per cent of the cases. The corresponding percentages obtained from the records of the children having 12 years of training are 0, 0 and 3.

It is well to recognize that in this evaluation of the speech characteristics the judgment is based on the enunciation of single words, not phrases or sentences. Consequently, the findings reported here are not to be interpreted to mean that the speech in general of the oral children retrogresses with duration of training, but only those elements of the speech

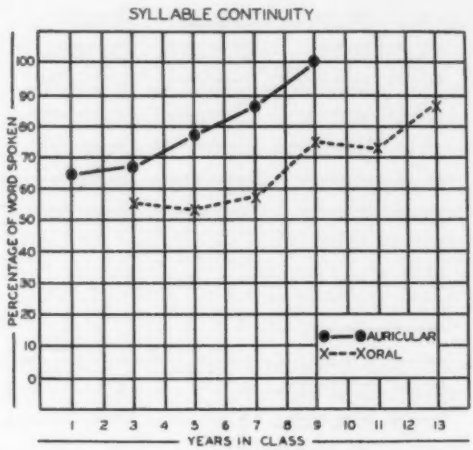


Chart 7i.

characteristics examined here. The data shown here reveal that children receiving oral training tend to deteriorate in the speech characteristics studied, even though their speech may improve otherwise with increased duration of training. On the other hand, the children receiving auricular training, with increased duration of training, improve also, and particularly with reference to expression and articulation of words and quality of vowel pronunciation.

Thus, from the above and preceding data one is led to infer that the methods of training are in themselves mainly responsible for the noted differences in the speech characteristics of

the two groups of children. This inference finds support from a comparison of the speech characteristics of children who have received previous to their auricular training one year or more of oral training with those children who received no such training, or at most less than one year. For purposes of simplification of discussion, the former will be labeled "some oral training," and the latter "no oral training." It should be

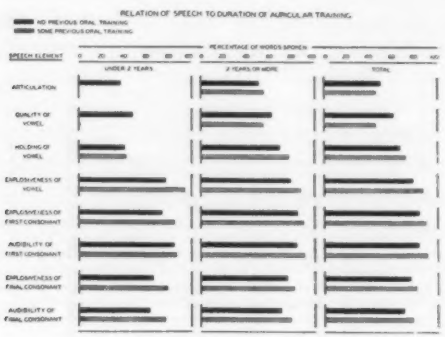


Chart 8.

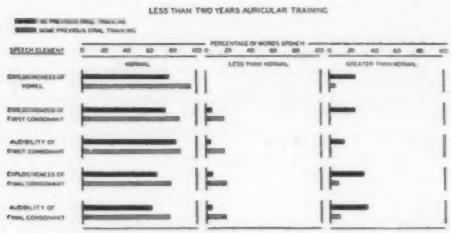


Chart 9.

noted that the former subgroup is on the average older than the latter. The comparison is presented in Charts 8 and 9.

From all of this it follows that, all other things being equal, the children who receive auricular training, in comparison with those who receive oral teaching, pronounce words with:

1. Less deviation from normal articulation and expression, and from normal enunciation of vowel.

2. Greater than normal emphasis in the pronunciation of the consonants.

DISCUSSION.

It is felt that the data reported above should serve a two-fold purpose. In the first place, a method of studying voice characteristics of deafened children is presented. Undoubtedly, modification of the method will result not only from further experience in its use but also by weighing the importance of suggested changes, of which there will surely be many. In the second place, it is shown that, regardless of age of onset, degree or duration of hearing loss, one teaching method, the auricular, is basically superior to the oral for all children with any residual hearing. This feeling has been current for some time amongst teachers of the deaf who have had experience with the auricular method. The present study confirms their opinion and further points the way toward an even wider application of the technique than had previously been thought possible. From these data it must be concluded that the young deaf child should be given the opportunity to receive this auricular training on admission to schools for the deaf. There is no evidence available that auricular training will prove a handicap to a child who might eventually have to be transferred to the oral group.

One further point warrants considerable elaboration. Some reference has already been made to it. The expense for education of handicapped children is relatively large. This type of education has for its chief purpose the training of a handicapped child to be a self-supporting and independent individual. The handicap of itself increases the required years of training before high school certification can be gained. In schools for normal children there is a normal sequence of achievement for all pupils. In schools for handicapped children, progress depends solely upon the individual child's ability to surmount the handicap. If it is possible to lower this particular barrier in any way, much will have been accomplished.

It can be conservatively estimated, on the basis of these findings, that the total period of education will be shortened by two years. If a child is in residence at a deaf school for

14 years, this means a reduction in time of one-seventh. A typical maintenance, as exemplified by the Pennsylvania School for the Deaf, is $635.00 per child per year. Every child who goes through high school and the two additional years required to obtain a vocational training certificate represents an outlay of $8,890.00. Auricular training shortens this total period by approximately two years, resulting in a saving of $1,290.00 per child so trained. It would seem that direct sponsorship of this auricular program by state boards of special education would be a practical method of furthering the education of the deaf child, and at the same time would achieve greater economy.

SUMMARY.

1. The speech characteristics of 366 children, resident in the Pennsylvania School for the Deaf, have been studied. Of this group, 248 had never received auricular training at the time of the study, and 118 were enrolled in auricular classes.

2. In general, comparison of the two groups shows that the speech of children given auricular training tends more toward that of the normal child than does that of the oral group.

3. Under all conditions of residual auditory acuity, the speech of the children trained by the auricular method is superior to that of the other children. Residual auditory acuity in children trained by the oral method apparently has no bearing on speech response.

4. The superiority of the auricular children is noted, regardless of age of onset of deafness, although in both groups of children there is a definite tendency for improvement in speech as the age of onset of deafness is raised.

5. With advancing age there is some improvement in the speech characteristics of both groups of children, but more marked in the children trained by the auricular method. At equal age, however, the superiority of the latter over the children trained by the oral method always persists.

6. In children trained by auricular method there is continuous improvement in speech characteristics with duration of training. No comparable improvement is observed for children trained by the oral method.

7. Children who receive oral training and are eventually placed in auricular classes are apparently retarded in their acquisition of speech.

BIBLIOGRAPHY.

1. GARRETT, EMMA: Annual Report of the Oral Branch of the Pennsylvania Institute for the Deaf and Dumb, Dec. 31, 1883.

2. GALLAUDET, E. M.: *Ann. Deaf*, 1898-1899.

3. CURRIER, A. F.: Proceedings of the Third Meeting of the American Association to Promote Teaching of Speech to the Deaf, 1895.

4. GILLESPIE, J. A.: Proceedings of the Second Meeting of the American Association to Promote Teaching of Speech to the Deaf, p. 123, 1892.

5. GOLDSTEIN, MAX A.: Problems of the Deaf. THE LARYNGOSCOPE PRESS, 1923.

6. GOLDSTEIN, MAX A.: The Acoustic Method for the Training of the Deaf and Hard-of-Hearing Child. THE LARYNGOSCOPE PRESS, 1939.

7. GUILDER, RUTH P., and HOPKINS, LOUISE A.: The Importance of Auditory Function Studies in the Educational Program for the Auditionally Handicapped Child. *Volta Rev.*, Feb. and March, 1936.

8. NEWHART, HORACE: The Early Detection and Treatment of Defective Hearing in Children. *Jour. A. M. A.*, 109:1620-1623. Nov. 13, 1937.

9. BODYCOMB, MARGARET: The Auricular Program in the Pennsylvania School for the Deaf. *Volta Rev.*, 39:4, April, 1937.

10. WATSON, RUTH B., and NORMAN A.: Hearing Aids in Schools for the Deaf. *Volta Rev.*, 39:5:261, May, 1937.

11. O'CONNOR, CLARENCE D.: The Use of Residual Hearing. (Report of Chairman of Committee on the Use of Residual Hearing of the American Association to Promote the Teaching of Speech to the Deaf.) *Volta Rev.*, 42:6:327, June, 1940.

12. HUGHSON, WALTER; CIOCCO, A., and PALMER, C. E.: Studies of Pupils of the Pennsylvania School for the Deaf. (1) Auditory Acuity. *Arch. Otolaryngol.*, 29:403-416, March, 1939.

13. CIOCCO, ANTONIO; HUGHSON, WALTER, and PALMER, CARROLL: Studies on Pupils of the Pennsylvania School for the Deaf. (2) Resemblances in the Auditory Acuity of Siblings. *Human Biol.*, May, 1939.

OTOGENOUS TETANUS.*†

DR. SAMUEL ROSEN, New York.

Most cases of otogenous tetanus reported in the literature are associated with injury or a foreign body. Inasmuch as most of the cases reported in the literature are by foreign authors, it would seem that this disease is rare in America or that it has been overlooked.

The case I am reporting is one of generalized tetanus complicating a chronic purulent otitis media, with recovery of tetanus bacilli from the middle ear, indicating that the middle ear may be the focus of a generalized tetanus. Very few such cases appear in the literature.

H. C., a male Negro, age 18 years, walked into the Mount Sinai Hospital on the morning of Dec. 23, 1939. For the past two years his right ear had been discharging. At times the discharge was foul. Four days before admission the patient noticed that his right upper lid was drooping and that he had some pain in the right side of his face on chewing. The temperature, pulse and respiration were normal. General physical examination was negative.

Examination of the right ear showed a large central perforation through which a mass of red, swollen mucosa of inner tympanic wall protruded. The discharge was mucopurulent and moderate in amount. The hammer handle was visible. No mastoid tenderness was present. The patient heard a moderately soft whisper. There was some right facial weakness.

The combination of chronic purulent otitis media of two years' duration with the onset of facial weakness and pain on swallowing usually is indication for radical mastoidectomy. But, somehow, I did not see clearly that this patient should be operated upon.

The patient could open his mouth to the limit, but on so doing complained of a "tightness" in the region of the right jaw joint. No satisfactory explanation could be found for this. The following morning the picture was essentially the same, except that the facial weakness was more marked and the patient could only half open his mouth. The blood count was normal and the Wassermann was negative.

The inability to open his mouth only half way impressed me, and on searching the literature that night I found that tetanus seemed to be the diagnosis which satisfied me most. The following morning I found the patient in opisthotonus, rigid neck, a cement-like rigidity of the abdomen, some rigidity of upper and lower extremities, and trismus was now almost complete. The patient was transferred to the medical service at once for tetanus therapy. The patient developed generalized tetanic convulsions, precipitated by noise or movement. Spinal fluid

*Read before the New York Academy of Medicine, Section on Otolaryngology, May 16, 1940.

†From the Otological Service of the Mount Sinai Hospital, New York.

Editor's Note: This ms. received in Laryngoscope Office and accepted for publication, July 1, 1940.

was negative. Avertin, amytal and ether were necessary to relax the patient. Stridor and laryngeal spasm necessitated tracheotomy. The temperature rose to 104° and respiratory rate to 50 per minute. Signs of bilateral lower lobar pneumonia appeared. One hundred thousand units of tetanus antitoxin for two days, then 50,000 units for several days were given intravenously. This was later reduced to 20,000, 10,000 and finally 5,000 units every three days. Altogether, 795,000 units of antitoxin were given within four weeks. The course of the pneumonia was very severe. At the end of two weeks the temperature became normal and the tetanic spasms had almost entirely disappeared. The right ear continued to discharge throughout. The perforation became larger. Cultures of the discharge taken from the right ear showed clostridium tetani (tetanus bacillus) and proteus bacillus. This was proved by inoculation of mice and guinea pigs. The animals inoculated with cultures died soon after, and tetanus bacilli were recovered. The animals inoculated with cultures plus tetanus antitoxin survived.

It was felt that the ear, as the tetanus focus, should be eradicated as far as possible, and thorough mastoidectomy was done. The mastoid bone was diploic, soft and cut easily. The posterior canal wall was taken down, the aditus opened widely and the ossicle could then be seen. They appeared normal. Cultures of the bone at operation were negative. At this point, when a modified radical mastoidectomy had been done, the patient went into shock, and the operation was stopped. It was decided later not to complete the radical but to observe the patient in the out-patient department. The culture taken just before operation, the specimen taken at the operation and those cultures taken since operation have all been negative for tetanus. The patient is well.

36 East 73rd Street.

RIGHT UPPER LOBE BRONCHOSCOPY — A POSITION THAT FACILITATES THE PROCEDURE.*

DR. WILLIAM B. FAULKNER, JR., San Francisco.

Since the right upper lobe bronchus arises at a right angle to the main stem trunk, difficulty is not infrequently encountered in inserting the instrument into the upper lobe for purposes of examination and treatment.

This technical difficulty can be surmounted if, after the bronchoscope has reached the right main bronchus, the patient's face is turned as far as possible to the left and kept in that position while the chin is brought down well over the left clavicle.

The intrabronchial view can be still further enhanced if, when the tip of the instrument has entered the upper lobe, a downward pressure is made in a caudad direction upon the external end of the bronchoscope. Then, by rotating the instrument the distal lighting will illuminate in turn the various minor bronchial openings.

In most cases the No. 9 Jackson-type bronchoscope is too large for this work; the No. 7 is generally quite serviceable; but a No. 5 (40 cm.) may be called for in certain instances.

384 Post Street.

---

*From the Thoracic Surgical Departments of St. Mary's and Mary's Help Hospitals, San Francisco.

Editor's Note: This ms. received in Laryngoscope Office and accepted for publication, Jan. 29, 1941.

A TRIBUTE.

SIR ST. CLAIR THOMSON, London.

With the death of Dr. Max A. Goldstein all workers in otolaryngology on both sides of the Atlantic lose a most able editor, a devoted investigator in the study and relief of deafness, and a man of high character.

As editor of THE LARYNGOSCOPE his record is remarkable. He founded this journal in 1896 and occupied the editorial chair for forty-five years. In the Jubilee Number of the journal last year, celebrating the fiftieth volume and also the seventieth birthday of the editor, one of his editorial staff addressed him as follows: "Fifty volumes of uninterrupted publication under one editor-manager is, so far as I know, a unique record for any professional journal and one which you may look back on with pardonable pride" (ARTHUR M. ALDEN, St. Louis). Another member of his staff expressed his opinion "that the success of THE LARYNGOSCOPE is due to your farsightedness and minute attention to every detail" (HENRY B. ORTON, Newark, N. J.). Many others insisted that the success of the journal was "solely due to his personal enthusiasm, vigor and ability." One assured him that: "A host of loyal friends and many admirers are proud of you and of the work that you have done for otolaryngology. I am sure you have nothing but proud and happy memories" (D. E. S. WISHART, Toronto). A junior colleague saluted him as "leader, healer, friend and teacher" (J. J. PRESSMAN, Los Angeles); while CHEVALIER JACKSON, referring not only to the journal but also to the editor's other interests, stressed "the tremendous load of clinical and literary work he had carried."

Personally, I had the good fortune to be associated with THE LARYNGOSCOPE from a very early period of its career. In the 90's of last century I occupied the leisure of my early struggling years by making some researches at the Lister Institute on the microbes of the nose and the fate of organisms in inspired air. The publication of my results must have caught the attention of a watchful editor, for Goldstein and I were then quite unknown to each other. I was surprised and pleased to receive an invitation from him to become the

European editor. I was further encouraged by his invitation to contribute a communication and was honored to find it published on the first page of Volume IV in 1898. During the 43 years which have passed since then, we have frequently met, but only at long intervals. They were sufficient to confirm my admiration for the devotion and skill of Dr. Goldstein both as editor and manager. From a slim beginning it has grown, both in size and quality, to be a magazine which no worker in the specialty can overlook. It well deserves the sub-title it now adds of "An International Monthly Journal." It is the official organ of the American Otological Society, of the section of our specialty in the New York Academy of Medicine, and of the Minnesota and other academies of otolaryngology. Not only has the standard of its contents risen but the energy, enterprise and imagination of the editor have secured the co-operation of a staff of 14 well known workers to whom he has entrusted the various sub-divisions, not only of such main matters as tracheobronchoscopy, laryngeal, surgical and otogenic complications, but also such more recent interests as Hearing Aids, Allergies, Plastic Surgery, Neck Infections, Vitamins, and so forth. The original articles are comprehensive and well documented by a copious bibliography. The constant reader is kept well informed by full and regularly recurring summaries of recent literature. These are not mere scissors-and-paste excerpts but reasoned epitomies and are frequently made more valuable by judicious criticisms interpolated by the abstracter. From time to time, these several sub-sections are responsible for the excellent Symposiums in which a discussion of some subject is considered from different angles — etiological, pathological, diagnostic, etc. — by selected workers in it.

Goldstein had other interests. He had, in the first instance, to make his own private practice, though the financial side of it was often neglected for his attention to scientific, philanthropic and other interests. Fortunately, soon after qualifying in 1893, the same year that I worked in Vienna, he visited that Mecca of otolaryngology and had the good fortune to come under the spell of that great pioneer and teacher, Adam Politzer. At the Poliklinik, he attended the class of Victor Urbantschitch, who was then working on the hypothesis that it was possible to arouse in deaf children a certain degree of

hearing by stimulating activity in the hearing centres. The idea attracted Goldstein and on his return home to establish himself in St. Louis, he enlisted the co-operation of the Mother-Superior and the teaching Sisters of the St. Joseph's School for the Deaf, and there modestly began his work with a small class of girls. It has to be remembered that in those days — the latter years of last century — the teaching of the deaf consisted chiefly in instructing them through the "deaf-and-dumb alphabet" by "finger-reading," and that lip-reading and the cultivation of any trace of hearing power was only beginning to receive consideration. Yet Goldstein was able, within two years, to give a demonstration before his colleagues of the progress possible. He then founded Central Institute for the Deaf in a couple of rooms and with only two teachers. In 1916 it moved to its own dwelling, and a few years later the foundation was laid of the building to complete it in 1928 and it is now one of the best equipped of similar institutions in the world, with accommodation for no less than 300 pupils and so well staffed that there is an average of one teacher to every five students. This great result was principally due to the untiring energy of Goldstein, demonstrating the beneficial results before the profession and the public, explaining the principles and methods employed, touring the country to obtain donations for the building and, all the time, developing the methods of training the deaf and organizing the classes for educating teachers in this specialized work. More than 500 skilled teachers have graduated from this institute.

The more scientific side of his work is embraced in his well known book of 600 pages entitled, "Problems of the Deaf," first published in 1933, while his methods for training "the deaf and hard-of-hearing child" appeared in a later book, "The Acoustic Method for Training the Deaf and Hard-of-Hearing Child."

As with other pioneers, his work was slow to gain recognition, but he lived to enjoy the great satisfaction of seeing it fully acknowledged. He was Professor of Otology in St. Louis University; he was a Fellow of the American College of Surgeons, and of that select and limited body, the American Laryngological Association; he was President of the American Otological Society, of the American Academy of

Ophthalmology and Oto-Laryngology, and of the large body of co-workers generally known as "The Triological Society."

The well known names of his editorial staff and of his collaborators are evidence that he had won the esteem of his most distinguished colleagues. But, in addition, he made many friends, for, as his oldest lieutenant wrote in the Jubilee Number: "His constant desire was to aid the underprivileged (M. D. LEDERMAN).

Goldstein frequently visited Europe. He attended congresses, but never sought for prominence at them. He had other interests. His philanthropic work for the deaf was foremost and it gave him great content. He had a love of art and culture and was early to recognize works of graphic art. Above all, with a devoted wife and daughter, he was happy in his home.

Last January he had the first warning of failing health by loss of power in his left arm and leg. But he had recovered enough by April to spend a half-day at his beloved institute. In July he was enjoying a holiday in his country cottage, and looking forward to an active, if limited, winter of work. Indeed, he was giving up a month of his vacation to prepare a new book on "Speech Pathology and Speech Correction."

It is not surprising, and one rejoices to hear, that Goldstein retained his placid good humor, his desire for work and his always inquiring intellect to the very last. He had always said he would like "to die with his boots on," and all of us may envy a man so gentle and happy after three score and ten years in which every minute had been so fully and generously filled. Knowing and appreciating Goldstein's temperament, I feel sure he agreed with Shakespeare that: "What's won is done; soul's joy lies in the doing." The same authority tells us: "If a man do not erect in this age his own tomb, ere he dies, he shall live no longer in monument than the bell rings and the widow weeps (Much Ado About Nothing, V. 2). After life's fitful fever, Goldstein sleeps well. The monument he created remains: his Research on Deafness, Central Institute for the Deaf and THE LARYNGOSCOPE.

NEW YORK ACADEMY OF MEDICINE.

SECTION ON OTOLARYNGOLOGY.

Regular Meeting, Jan. 15, 1941

A Case of Otitic Meningitis Pneumonic Type III with Recovery. Dr. Alvin M. Street.

(To be published in a subsequent issue of THE LARYNGOSCOPE.*)*

Frontal Sinusitis; Osteomyelitis and Meningitis; Operation; Recovery. Dr. J. Swift Hanley.

(To be published in a subsequent issue of THE LARYNGOSCOPE.*)*

Chronic Mastoiditis, Meningitis, Labyrinthitis Operation, Recovery. Dr. Jackson A. Seward.

(To be published in a subsequent issue of THE LARYNGOSCOPE.*)*

(1) Squamous Cell Carcinoma of Larynx. (2) Foreign Body in Right Maxillary Sinus. Case Reports. Dr. Eugene Moyle.

(To be published in a subsequent issue of THE LARYNGOSCOPE.*)*

Specimen of Healed Petrositis (with moving picture demonstration). Dr. J. W. Fowlkes.

(To be published in a subsequent issue of THE LARYNGOSCOPE.*)*

Cancer of the Paranasal Sinuses. Dr. W. L. Watson.

(To be published in a subsequent issue of THE LARYNGOSCOPE.*)*

DISCUSSION.

DR. DOUGLAS QUICK: First, I would like to express my appreciation for Dr. Watson's very excellent paper. There is little I can add, other than to indorse what he has said, and perhaps emphasize certain of his points. His incidence and age distribution records are particularly interesting, and show that the young are by no means immune to malignant disease within the sinuses.

In the matter of diagnosis, Dr. Watson noted a correct X-ray diagnosis in 83 per cent. I think I should rather call that a confirmatory diagnosis, because I don't think we can make a diagnosis by X-rays if there is no bone involvement. I don't believe there is any difference between the shadow of swollen membranes and that of a solid tumor. On the other hand, where bone destruction is demonstrated Roentgenographically, it does not necessarily mean that the process is neoplastic. I have often felt very much discouraged with the aid of X-rays alone in the matter of diagnosis, and I think we come down finally to the biopsy as the one means of settling it, and on that score, I think that if more tissues from the sinuses were examined routinely, we might see a substantial number of cancer cases in an earlier phase of development than we now

do. For the most part, they are a rather late group of cases at present when they come under active treatment.

Dr Watson's histologic incidence is important also. I think we often hear rather loose mention made of sarcoma of the antrum; yet you saw in his table that only 1 per cent were true sarcomas, and that the predominant type is epithelioma.

The incidence of metastases is extremely interesting to me. In the group that he was able to check up very completely, he had 18 who were admitted with metastatic involvement, and 19 who developed metastases after admission. That is a bit higher percentage than Dr. Hayes Martin reported a few months ago, if my memory serves correctly, in a group of tongue cases where he reported the incidence of metastatic involvement after admission was something like 5 per cent, and I think he expressed that as a reason for not radiating the necks of those who came in without metastatic involvement. I realize that sinus cases as a group are much more advanced than tongue cases — that would be quite natural.

On the other hand, in the group of cases Dr. Watson has reported tonight, the fact that only two cases ultimately survived does not mean that the others necessarily lost their lives on account of metastatic involvement of the neck, because I think it is fair to assume that many of them died on account of the extent of the primary growth, and therefore the presence of metastases did not make very much difference in the end.

In the matter of treatment, I don't think there is any such thing as wide removal of the growth surgically in cancer of the sinuses, in the sense that we speak of wide surgical removal of growths elsewhere. I agree that a small growth may be hit upon by accident in the course of operating for an ordinary sinusitis, but even there I doubt if we could consider the removal under those circumstances as truly wide removal.

I agree very thoroughly with Dr. Watson's Plans A, B and C for treatment, depending upon the extent of the disease, the condition of the patient, and so forth, with emphasis on radiation as the curative factor, and surgery for access and greater accuracy, and also for drainage. I think the matter of drainage cannot be overemphasized. After all, infection carries a good many of these people away, and, besides that, adequate and satisfactory reaction to radiation cannot be obtained in the presence of pent-up infection. I am highly in favor of high-voltage radiation in all of these cases at first, with perhaps a little less intensity than Dr. Watson has carried out in a number of them. I do not feel partial to the use of gold seeds implanted in this region in the average case, but think heavily filtered platinum is preferable because it occupies less bulk. If that is used, my feeling is that there is less osteoradionecrosis than with the lighter filter of the gold seed even though the dosage be a bit heavier.

I think Dr. Watson has demonstrated the value of antrotomies. Sixteen and seven-tenths per cent are well five years after, even though he did the antrotomies in such an extensive type of involvement. This is decidedly worth while. I would stress what he showed in the diagram — leaving the antrum wide open and closing it later with a prosthetic appliance rather than closing the defect surgically. I would also like to call attention to one of the diagrams he showed while reading his paper, demonstrating the extensive exenteration of the orbit where the disease has extended into that structure. I think that is very definitely a lifesaving measure and one that should not be stopped short of where the extension inside has presumably not gone too far back, because it does permit getting ahead of the disease, and I think the prosthetic appliance will do very nicely afterwards, to cover up the defect. There is an occasional case where the social status of the patient may warrant a series of extensive plastic procedures, but in the average case the prosthetic appliance is much to be preferred, and also permits more careful subsequently observation of the case. In addition, it does not shift about tissues that may harbor a recurrence later. If one resorts to a series of plastic operations, one is apt to turn in tissues around which a recurrence is most apt to occur. They have on the service at Memorial

Hospital, Dr. Ackerman, whose unusual dental work, and along with that the making of these appliances, is a remarkable achievement.

Dr. Watson mentioned the matter of radiosensitivity of the tumor in the ultimate prognosis, and I just wondered if a better result in radiosensitive tumors isn't outweighed by the greater incidence of distant and widespread metastases.

Finally, I am glad indeed that Dr. Watson did not go into much discussion of how paranasal malignancies extend into the base of the skull cap, whether along the vessels and through the foramina, or by erosion, etc., because there has been a great deal of controversy on the subject and, after all, when they get there the patient is beyond the active aid of the surgeon anyway.

Dr. Leopold Glushak: May I ask Dr. Watson what his experience has been in regard to the effect of radiation on the temporomaxillary joint; have they obtained ankylosed joints at Memorial Hospital and, if so, have they been able to obviate stiffening of the joint? What have they done for ankylosis resulting from deep X-ray therapy?

Dr. William L. Watson: A good many of these patients have a certain amount of trismus as a result of infection and irradiation. As far as I can recall, no operative procedure for this has ever been necessary in our experience. We have devised a sort of jaw-stretcher, and after the patients are free of disease they use it themselves and get back a reasonable amount of function in the jaw. As far as I know, we have never operated and have never had a complete ankylosis.

DIRECTORY OF NATIONAL OTOLARYNGOLOGIC SOCIETIES.

American Otological Society.

President: Dr. E. M. Seydell, 107 W. Douglas Avenue, Wichita, Kan.

Secretary: Dr. Isidore Friesner, 101 E. 73rd Street, New York.

American Academy of Ophthalmology and Otolaryngology.

President: Dr. Frank R. Spencer, Physicians' Building, Boulder, Colo.

President-Elect: Dr. Ralph I. Lloyd, 14 8th Avenue, Brooklyn.

Executive Secretary: Dr. William P. Wherry, 1500 Medical Arts Building, Omaha.

Place: Chicago. Time: Oct. 19-24, 1941.

American Broncho-Esophagological Association.

President : Dr. W. Likely Simpson, 899 Madison Avenue, Memphis.

Secretary: Dr. Paul Holinger, 1150 N. State Street, Chicago.

American Laryngological Association.

President: Dr. T. E. Carmody, 227 16th Street, Denver.

Secretary: Dr. Charles J. Imperatori, 108 E. 38th Street, New York.

American Laryngological, Rhinological and Otological Society, Inc.

President: Dr. James A. Babbitt, 1912 Spruce Street, Philadelphia.

President-Elect: Dr. James G. Dwyer, 375 Park Avenue, New York.

Secretary: Dr. C. Stewart Nash, 708 Medical Arts Building, Rochester, N. Y.

Sections:

Eastern—Chairman: Dr. Henry P. Johnson, 32 Deering Street, Portland, Maine.

Southern—Chairman: Dr. William L. McDougall, 915 Doctors' Building, Atlanta,.

Middle—Chairman: Dr. William E. Sauer, 3720 Washington Boulevard, St. Louis.

Western—Chairman: Dr. Emil F. Tholen, 1136 W. 6th Street, Los Angeles.

American Medical Association, Scientific Assembly, Section on Laryngology, Otology and Rhinology.

Chairman: Dr. Gordon F. Harkness, 215 Main Street, Davenport, Iowa.

Secretary: Dr. Louis H. Clerf, 1530 Locust Street, Philadelphia.